ROSS' CELEBRATED LENSES

And ZEISS' AND GOERZ' ANASTIGMATS.

AN ABSOLUTELY UNEQUALLED SELECTION
FOR EVERY DEPARTMENT OF PHOTOGRAPHY.

Index to Text, pages 1127 to 1134.
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1906.

JANUARY.							FEBRUARY							MARCH.						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
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POSTAL AND TELEGRAPHIC ADDRESSES,
1259 to 1272.

ROSS'

PATENT 'HOMOCENTRIC' LENSES

AN UNRIVALLED NEW SERIES.

See pa es 35 to 98.

JANUARY.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. Morn.	Moon. Sets. After.
1	M		8 8	3 59	11 37	11 24
2	Tu	☽ 2.52 A.	8 8	4 0	11 59	Morn
3	W		8 8	4 1	0a20	0 28
4	Th	First R.P.S. Exhibition, 1854	8 8	4 2	0 42	1 32
5	F		8 8	4 3	1 6	2 35
6	S	Epiphany	8 7	4 4	1 33	2 38
7	S	1st Sunday after Epiphany	8 7	4 5	2 5	4 40
8	M		8 6	4 7	2 43	5 41
9	Tu		8 6	4 9	3 28	6 38
10	W	German Copyright Act, ○ 4.37 A.	8 5	4 10	4 22	7 31
11	Th	[1876	8 5	4 11	5 24	8 17
12	F		8 4	4 12	6 32	8 57
13	S	Wm. Bedford d. 1893	8 4	4 13	7 43	9 31
14	S	Prof. Ernst Abbè d. 1905	8 3	4 15	8 57	10 0
15	M		8 2	4 16	10 12	10 27
16	Tu	Washed Emulsion, Bolton, 1874	8 2	4 18	11 28	10 53
17	W	☾ 8.49 A.	8 1	4 20	Morn	11 19
18	Th	Finder invented (Taupenot) 1856	8 0	4 22	0 45	11 46
19	F	Henri Boissonnas d. 1889	7 59	4 23	2 3	0a17
20	S	Photo. Soc. of Lon. (R.P.S.) f. 1853	7 58	4 25	3 19	0 52
21	S	3rd Sunday after Epiphany	7 57	4 26	4 33	1 34
22	M		7 56	4 28	5 42	2 26
23	Tu		7 55	4 30	6 41	3 25
24	W	5.9 A.	7 54	4 32	7 32	4 31
25	Th	Talbot's Prints first shown, 1839	7 52	4 34	8 13	5 41
26	F		7 51	4 35	8 47	6 51
27	S	Sulphite in developer, Berkeley, '82	7 50	4 37	9 14	8 0
28	S	Photo-sculpture pat. by Willème	7 49	4 39	9 39	9 8
29	M	[1863	7 47	4 40	10 2	10 14
30	T	[Royal Soc. 1839	7 46	4 42	10 24	11 18
31	W	Fox Talbot's first communication to	7 44	4 44	10 46	Morn

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FEBRUARY.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. Morn.	Moon. Sets. Morn.
1	Th	☽ 0.31 A.	7 41	4 48	11 9	0 21
2	F		7 39	4 49	11 34	1 24
3	S	J. R. Johnson's carbon pat., 1869	7 38	4 51	0a 3	2 26
4	S	5th Sunday after Epiphany	7 36	4 53	0 39	3 27
5	M		7 34	4 55	1 21	4 25
6	Tu	Print made by Talbot, 1836	7 33	4 57	2 10	5 19
7	W		7 31	4 58	3 8	6 8
8	Th	Calotype Process pat. 1841	7 29	5 0	4 15	6 52
9	F	○ 7.46 M.	7 27	5 2	5 27	7 29
10	S	Sir David Brewster d. 1868	7 25	5 4	6 42	8 1
11	S	Fox Talbot b. 1800	7 24	5 6	7 59	8 30
12	M		7 22	5 8	9 16	8 57
13	Tu		7 20	5 10	10 34	9 24
14	W		7 18	5 12	11 51	9 51
15	Th		7 16	5 13	Morn	10 20
16	F	☾ 4.23 M.	7 14	5 15	1 8	10 53
17	S		7 12	5 17	2 23	11 33
18	S	Sexagesima Sunday	7 10	5 19	3 31	0a20
19	M	[Soc., 1840	7 8	5 20	4 32	1 14
20	Tu	Sir John Herschel's paper at Royal	7 6	5 22	5 25	2 17
21	W	Talbot's paper at Royal Soc., 1839	7 4	5 24	6 9	3 24
22	Th		7 2	5 26	6 46	4 33
23	F	● 7.57 M.	7 0	5 28	7 15	5 42
24	S		6 58	5 30	7 41	6 51
25	S	Quinquagesima Sunday.	6 56	5 31	8 4	7 58
26	M		6 54	5 33	8 26	9 3
27	Tu		6 52	5 34	8 48	10 7
28	W		6 50	5 35	9 11	11 10

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MARCH.

D. M.	D. W.	Remarkable Events.		Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. Morn.	Moon. Sets. Morn.
1	Th			6 50	5 36	9 35	Morn
2	F	Dr. Hurter d. 1898		6 48	5 38	10 3	0 13
3	S	Daguerre's Diorama destroyed, 1839	☽ 9.28 M.	6 46	5 40	10 34	1 14
4	S	Poitevin d. 1882		6 44	5 42	11 12	2 13
5	M	J. Albert b. 1825		6 41	5 44	11 58	3 8
6	Tu			6 39	5 46	0a52	4 0
7	W	J.N. Niepce b. 1765. Herschel b. 1792		6 37	5 47	1 55	4 44
8	Th			6 35	5 49	3 3	5 23
9	F	J. B. Reade's process, 1839		6 32	5 51	4 17	5 58
10	S		○ 8.17 A.	6 30	5 53	5 35	6 29
11	S	2nd Sunday in Lent.		6 28	5 54	6 54	6 57
12	M			6 26	5 56	8 15	7 24
13	Tu			6 23	5 57	9 36	7 5.
14	W	Herschel's process Royal Soc., 1839		6 21	5 59	10 56	8 21
15	Th	Dr. Hurter b. 1844		6 19	6 1	Morn	8 54
16	F	Collodio Chl. G. W. Simpson, 1865		6 17	6 3	0 13	9 32
17	S		☾ 11.57 A.	6 14	6 4	1 25	10 17
18	S	3rd Sunday in Lent		6 12	6 6	2 29	11 10
19	M	Thomas Sutton d. 1875		6 10	6 7	3 23	0a 9
20	Tu			6 8	6 9	4 8	1 13
21	W			6 5	6 11	4 46	2 22
22	Th	Liverpoool P. S. founded 1853		6 3	6 13	5 17	3 30
23	F			6 1	6 14	5 44	4 37
24	S	Becquerel b. 1820	● 11.52 A.	5 59	6 16	6 8	5 44
25	S	4th Sunday in Lent		5 56	6 17	6 30	6 50
26	M			5 54	6 19	6 51	7 55
27	Tu	John Pouncey d. 1894		5 52	6 21	7 13	8 59
28	W			5 49	6 23	7 37	10 2
29	Th	Bennett's emulsion process, 1878		5 47	6 24	8 3	11 3
30	F			5 45	6 26	8 33	Morn
31	S			5 42	6 28	9 8	0 2

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APRIL.

D. M.	D. W.	Remarkable Events.		SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. Morn.	MOON. Sets. Morn.
1	S	5th Sunday in Lent	Emil Busch	5 40	6 29	9 49	0 59
2	M		[d. 1888 ☽ 4.2 M.	5 38	6 31	10 38	1 52
3	Tu			5 36	6 33	11 36	2 38
4	W			5 34	6 35	0a40	3 19
5	Th	Rev. J. B. Reade b. 1801		5 31	6 36	1 51	3 55
6	F			5 29	6 38	3 7	4 26
7	S	Voigtländer d. 1878.		5 27	6 39	4 26	4 55
8	S	Palm Sunday		5 25	6 41	5 47	5 23
9	M		○ 6.12 M.	5 22	6 43	7 9	5 50
10	Tu	Gum Bichromate pat. 1858		5 20	6 45	8 33	6 18
11	W	Willis Aniline process 1865		5 18	6 46	9 54	6 50
12	Th	Steinheil b. 1832		5 16	6 48	11 12	7 27
13	F			5 13	6 49	Morn	8 11
14	S			5 11	6 51	0 22	9 3
15	S	Easter Sunday	8.	5 9	6 52	1 21	10 1
16	M			5 7	6 54	2 10	11 5
17	Tu			5 5	6 56	2 51	0a12
18	W	Ponton's Bichromate process, 1839		5 2	6 58	3 22	1 20
19	Th	Warren de la Rue d. 1889		5 0	7 0	3 49	2 29
20	F			4 58	7 1	4 14	3 36
21	S	Talbot's Photo.-etch. Proc. pat. 1858		4 56	7 2	4 36	4 41
22	S	Low Sunday.		4 54	7 4	4 57	5 45
23	M		● 4.7 A.	4 52	7 6	5 18	6 49
24	Tu			4 50	7 8	5 40	7 52
25	W	Dr. Miethe b. 1862		4 48	7 9	6 5	8 55
26	Th	Adam Salomon d. 1881		4 46	7 11	6 34	9 56
27	F			4 44	7 12	7 7	10 54
28	S	Plener's stripping process, 1882		4 42	7 14	7 45	11 48
29	S	2nd Sunday after Easter.		4 40	7 16	8 32	Morn
30	M	Col. Stuart Wortley d. 1890		4 38	7 18	9 25	0 36

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MAY.

D. M.	D. W.	Remarkable Events.		Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. Morn.	Moon. Sets. Morn.
1	Tu		☽ 7.7 A.	4 36	7 19	10 25	1 17
2	W			4 35	7 21	11 31	1 54
3	Th			4 33	7 22	0a42	2 26
4	F			4 31	7 24	1 57	2 54
5	S	J. W. Draper b. 1811		4 29	7 25	3 16	3 21
6	S	Humboldt d. 1859		4 27	7 27	4 37	3 48
7	M			4 25	7 28	6 0	4 15
8	Tu	P. Meagher d. 1897	○ 2.10 A.	4 24	7 30	7 24	4 45
9	W			4 22	7 32	8 46	5 19
10	Th	South London Photo. Soc. f. 1859		4 20	7 34	10 3	5 59
11	F	R. L. Maddox d. 1902. J. N. Niepce		4 18	7 35	11 10	6 48
12	S	W. B. Bolton d. 1899 [d. 1871		4 17	7 37	Morn	7 46
13	S	Dr. P. H. Emerson b. 1856		4 15	7 38	0 6	8 51
14	M	Fahrenheit b. 1686		4 14	7 40	0 51	10 0
15	Tu		☾ 7.3 M.	4 12	7 41	1 27	11 10
16	W	Major C. Russell d. 1887		4 11	7 43	1 55	0a19
17	Th			4 9	7 44	2 21	1 27
18	F			4 8	7 46	2 43	2 33
19	S			4 6	7 47	3 3	3 38
20	S	Rogation Sunday.		4 5	7 49	3 24	4 42
21	M	Scheele d. 1776		4 4	7 50	3 46	5 46
22	Tu			4 3	7 51	4 10	6 49
23	W	B. J. Sayce d. 1895	● 8.1 M.	4 1	7 52	4 37	7 50
24	Th			4 0	7 54	5 8	8 49
25	F			3 59	7 55	5 44	9 44
26	S	H. B. Berkeley d. 1890		3 58	7 57	6 27	10 34
27	S	Sunday after Ascension		3 57	7 58	7 18	11 18
28	M			3 56	7 59	8 16	11 56
29	Tu			3 55	8 0	9 19	Morn
30	W			3 54	8 2	10 28	0 29
31	Th		☽ 6.24 M.	3 53	8 4	11 39	0 58

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JUNE.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	Sets. H. M.	MOON. Rises. After.	Sets. Morn.
1	F	Talbot's patents 1841	3 52	8 4	0 53	1 25
2	S		3 50	8 5	2 10	1 50
3	S	Whit Sunday	3 50	8 6	3 30	2 15
4	M		3 49	8 7	4 52	2 42
5	Tu	First Platinotype patent, 1873	3 49	8 8	6 16	3 13
6	W	○ 9.12 A.	3 48	8 9	7 37	3 49
7	Th		3 47	8 10	8 51	4 34
8	F		3 46	8 11	9 54	5 27
9	S	Alvan Clark d. 1897	3 46	8 12	10 45	6 31
10	S	Talbot on Calotype at the Royal	3 46	8 13	11 26	7 40
11	M	[Society, 1841	3 46	8 13	11 59	8 52
12	Tu		3 45	8 14	Morn	10 4
13	W	☾ 7.34 A.	3 45	8 14	0 26	11 14
14	Th	Daguerre received pension, 1839	3 45	8 15	0 49	0a22
15	F	Bertsch's fixed focus camera, 1860	3 45	8 15	1 11	1 28
16	S	Chrysotype and Cyanotype Pro-	3 44	8 16	1 31	2 32
17	S	[com. to Royal Soc., 1842	3 44	8 16	1 52	3 36
18	M		3 44	8 17	2 14	4 40
19	Tu	Kennet emulsion marketed, 1874	3 44	8 17	2 39	5 42
20	W	[duced, 1858	3 45	8 18	3 9	6 42
21	Th	Waterhouse stop intro- ● 11.6 A.	3 45	8 18	3 44	7 39
22	F	Sir J. W. Swan's brom. paper pat.	3 45	8 18	4 25	8 32
23	S	E. L. Wilson d. 1903	3 45	8 19	5 13	9 19
24	S	Hardwich d. 1890	3 46	8 19	6 9	9 59
25	M		3 46	8 19	7 11	10 33
26	Tu	Liesegang b. 1839	3 47	8 19	8 18	11 3
27	W	Wothley d. 1873	3 47	8 18	9 29	11 31
28	Th	[pub. 1877	3 47	8 18	10 41	11 56
29	F	Ferrous-oxalate Developer ☽ 2.19 A.	3 47	8 18	1 54	Morn
30	S	Marten's Panoramic Camera, 1845	3 48	8 18	1a 9	0 20

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JULY.

D. M.	D. W.	Remarkable Events.	Sun Rises. H. M.	Sun Sets. H. M.	Moon Rises. After.	Moon Sets. Morn.
1	S	3rd Sun. aft. Trin. Copyright Act	3 48	8 19	2 28	0 45
2	M	[passed, 1862	3 49	8 18	3 49	1 12
3	Tu		3 50	8 17	5 9	1 43
4	W		3 50	8 17	6 26	2 22
5	Th	Nicephore Niepce d. 1833	3 51	8 16	7 35	3 10
6	F	W. J. Stillman d. 1901 ○ 4.28 M.	3 52	8 16	8 33	4 9
7	S		3 53	8 15	9 19	5 16
8	S	4th Sun. aft. Trin.	3 54	8 15	9 57	6 29
9	M		3 55	8 14	10 27	7 43
10	Tu	Daguerre d. 1851	3 56	8 14	10 52	8 56
11	W		3 57	8 13	11 15	10 7
12	Th	Second platinotype patent 1878	3 58	8 12	11 37	11 14
13	F	☾ 10.13 M.	3 59	8 11	11 58	0a 21
14	S		4 0	8 10	Morn	1 26
15	S	5th Sun. aft Trin.	4 1	8 9	0 20	2 30
16	M		4 2	8 8	0 44	3 33
17	Tu		4 3	8 7	1 11	4 34
18	W	Gelatine emulsion first advt. 1873	4 5	8 6	1 44	5 32
19	Th	The Copyright Union founded 1893	4 6	8 5	2 22	6 26
20	F	Collodion Pos. Process pub. 1852	4 7	8 4	3 8	7 15
21	S	Reflex camera pat. ● 0.59 A.	4 8	8 3	4 1	7 59
22	S	6th Sun. aft. Trin. [(Sutton) 1861	4 9	8 2	5 2	8 35
23	M	[General Waterhouse b. 1842	4 11	8 1	6 9	9 7
24	Tu	Sir William Abney b. 1843. Major	4 11	7 59	7 18	9 34
25	W		4 14	7 58	8 30	10 0
26	Th	Niepce de St. Victor b. 1806	4 14	7 56	9 44	10 25
27	F		4 16	7 54	10 58	10 49
28	S	Earl of Crawford b. 1847. Talbot	4 16	7 53	0a14	11 15
29	S	[ceded pat. rights 1852. ☽ 7.56 A.	4 19	7 52	1 32	11 44
30	M		4 19	7 51	2 50	Morn
31	T		4 22	7 50	4 6	0 19

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AUGUST.

D. M.	D. W.	Remarkable Events.	Sun Rises. H. M.	Sun Sets. H. M.	Moon Rises. After.	Moon Sets. Morn.
1	W		4 24	7 47	5 17	1 2
2	Th		4 25	7 46	6 19	1 54
3	F	Mungo Ponton d. 1880	4 27	7 44	7 11	2 56
4	S	Dr. R. L. Maddox b. 1816 ◎ 1.0 A.	4 28	7 43	7 52	4 5
5	S	8th Sun. aft. Trin. W. K. Burton	4 30	7 41	8 26	5 18
6	M	[d. 1899	4 32	7 39	8 54	6 33
7	Tu		4 33	7 37	9 18	7 46
8	W	Roger Fenton d. 1869. Ed. Valenta	4 35	7 36	9 40	8 56
9	Th	[b. 1857	4 36	7 34	10 2	10 4
10	F	W. H. Harrison d. 1897. Fizeau	4 38	7 32	10 24	11 11
11	S	[intro. gold toning, 1840	4 39	7 30	10 47	0a15
12	S	9th Sun. after Trin. ☾ 2.43 M.	4 41	7 28	11 12	1 19
13	M	Sir G. G. Stokes. b. 1819, d. Feb. 8,	4 43	7 26	11 42	2 21
14	Tu	Daguerre's Eng. pat. 1839 [1903	4 44	7 25	Morn	3 21
15	W		4 45	7 24	0 18	4 18
16	Th	Lavoisier b. 1743	4 47	7 21	1 0	5 10
17	F		4 48	7 19	1 51	5 55
18	S		4 50	7 17	2 50	6 35
19	S	10th Sun. aft. Trin.	4 51	7 15	3 54	7 8
20	M	Daguerrotype pub. 1839 ● 1.28 M.	4 53	7 13	5 4	7 38
21	Tu	Chevreul b. 1786	4 55	7 11	6 17	8 5
22	W		4 57	7 9	7 32	8 30
23	Th		4 58	7 7	8 48	8 54
24	F	Scott-Archer collodion pat. 1855	5 0	7 4	10 5	9 19
25	S	Faraday d. 1867	5 1	7 2	11 22	9 47
26	S	11th Sun. aft. Trin. Daguerre	5 3	6 50	0a40	10 19
27	M	[Mem. uncov. 1883 ☽ 0.43 M.	5 4	6 58	1 55	10 59
28	Tu		5 5	6 56	3 6	11 46
29	W		5 7	6 54	4 10	Morn
30	Th	Oliver Sarony died 1879	5 9	6 51	5 3	0 43
31	F		5 11	6 50	5 48	1 48

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SEPTEMBER.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	S	Norris's Dry-plate Process pat. 1856	5 12	6 47	6 24	2 59
2	S	12th Sun. aft. Trin. ○ 11.36 A.	5 13	6 45	6 53	4 12
3	M		5 15	6 42	7 18	5 25
4	Tu		5 17	6 40	7 41	6 37
5	W	W. B. Woodbury d. 1885	5 19	6 38	8 3	7 47
6	Th		5 21	6 36	8 25	8 55
7	F	Poitevin Mem. inaug., 1885	5 22	6 34	8 48	10 1
8	S	Gel -bro. Proc.pub. by Maddox, 1871	5 24	6 31	9 12	11 6
9	S	13th Sun. aft. Trin. Col.-bro. Proc.	5 25	6 29	9 40	0a 9
10	M	[pub. 1864. ☾ 8.54 A.	5 27	6 27	10 14	1 10
11	Tu		5 28	6 25	10 54	2 8
12	W		5 30	6 22	11 41	3 2
13	Th		5 31	6 20	Morn	3 49
14	F		5 33	6 18	0 35	4 30
15	S	Petzval d. 1891	5 35	6 16	1 36	5 7
16	S	Panoramic lens (Sutton) p. 1861	5 36	6 13	2 45	5 38
17	M	Fox Talbot d. 1877	5 38	6 11	3 57	6 5
18	Tu	Leon Foucault b. 1819 0.34 A.	5 39	6 9	5 13	6 31
19	W	T. Grubb d. 1878	5 41	6 7	6 30	6 56
20	Th	Talbot Discovers Development 1840	5 43	6 4	7 49	7 21
21	F	Stas b. 1813	5 44	6 2	9 8	7 49
22	S	Faraday b. 1791. Thos. Sutton b	5 45	5 59	10 28	8 21
23	S	Woodbury type pat. 1864 [1819	5 47	5 57	11 46	8 58
24	M	[b. 1834, d. 1882	5 49	5 55	1a 0	9 43
25	Tu	Dr. Van Monckhoven ☽ 6.12 M.	5 51	5 53	2 6	10 36
26	W		5 53	5 50	3 2	11 38
27	Th		5 54	5 48	3 47	Morn
28	F		5 55	5 46	4 25	0 47
29	S		5 57	5 44	4 55	1 58
30	S	16th Sunday after Trinity.	5 58	5 41	5 22	3 10

Historical notes on many of the above items appear in each issue of THE BRITISH JOURNAL OF PHOTOGRAPHY for 1905.

OCTOBER.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	M		6 0	5 38	5 45	4 21
2	Tu	○ 0.48 A.	6 2	5 36	6 7	5 31
3	W		6 4	5 34	6 28	6 40
4	Th		6 5	5 32	6 50	7 47
5	F	Louis Lumière b. 1864	6 7	5 30	7 14	8 53
6	S	[d. 1900	6 9	5 27	7 41	9 57
7	S	17th Sun. aft. Trin. Leon Warnerke	6 10	5 25	8 12	10 59
8	M		6 12	5 23	8 48	11 58
9	Tu		6 14	5 20	9 31	0a54
10	W	☾ 3.39 A.	6 16	5 18	10 21	1 43
11	Th		6 17	5 16	11 19	2 26
12	F		6 18	5 14	Morn	3 4
13	S		6 20	5 12	0 23	3 36
14	S	18th Sun. aft. Trin. J. J. Elliot	6 22	5 10	1 33	4 4
15	M	[b. 1835, d. March 30, 1903	6 24	5 7	2 47	4 31
16	Tu		6 26	5 5	4 4	4 56
17	W	Dr. Neuhauss b. 1855 ● 10.43 A.	6 27	5 3	5 23	5 21
18	Th	Wheatstone d. 1875	6 29	5 1	6 44	5 48
19	F	Aug. Lumière b. 1862	6 31	4 59	8 6	6 18
20	S		6 32	4 57	9 29	6 54
21	S	19th Sun. aft. Trin.	6 34	4 55	10 48	7 37
22	M		6 36	4 53	11 59	8 29
23	Tu		6 38	4 51	1a 0	9 29
24	W	☽ 1.50 A.	6 39	4 49	1 49	10 37
25	Th	Vernon Heath d. 1895	6 41	4 47	2 29	11 48
26	F		6 43	4 45	3 1	Morn
27	S	[Silver Process pub. 1864	6 45	4 43	3 28	1 0
28	S	20th Sun. aft. Trin. Col.-chlo. of	6 46	4 41	3 51	2 11
29	M	Talbot Photo-eng. Process pat. 1852	6 48	4 39	4 12	3 20
30	Tu		6 50	4 37	4 33	4 28
31	W		6 52	4 35	4 54	5 35

Historical notes on many of the above items appear in each issue of THE BRITISH JOURNAL OF PHOTOGRAPHY for 1905.

NOVEMBER.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. After	Moon. Sets. Morn.
1	Th	○ 4.46 M.	6 53	4 32	5 16	6 41
2	F		6 55	4 31	5 41	7 46
3	S		6 57	4 29	6 10	8 50
4	S	Statue to Daguerre at Bry, 1852	7 0	4 28	6 44	9 51
5	M		7 1	4 26	7 24	10 48
6	Tu	Senefelder b. 1771	7 2	4 24	8 12	11 39
7	W	Col. C. G. H. Kinnear d. 1894	7 4	4 23	9 6	0a25
8	Th	J. Traill Taylor d. 1895 [pat. 1854	7 6	4 21	10 7	1 3
9	F	Pretsch's Pho.-eng. Pro. ☾ 9.45 M.	7 8	4 20	11 14	1 37
10	S	Orthochromatism, Vogel 1873	7 9	4 18	Morn	2 6
11	S	22nd Sun. aft. Trin.	7 11	4 17	0 24	2 32
12	M		7 13	4 16	1 37	2 56
13	Tu	Sir H. Trueman Wood b. 1845	7 15	4 15	2 53	3 20
14	W		7 16	4 13	4 12	3 46
15	Th		7 18	4 12	5 34	4 14
16	F	● 8.37 A.	7 20	4 9	6 59	4 46
17	S		7 22	4 8	8 23	5 26
18	S	23rd Sun. aft. Trin. Daguerre b.	7 23	4 6	9 41	6 15
19	M	[1787	7 25	4 5	10 49	7 14
20	Tu	Kennett's Pellicle pat. 1873	7 27	4 4	11 46	8 22
21	W		7 28	4 3	0a31	9 35
22	Th	Schlippe b. 1749	7 30	4 2	1 6	10 49
23	F	Harrison (Inv. of Globe ☽ 0.39 M.	7 32	4 1	1 34	Morn
24	S	[Lens), d. 1864	7 33	3 59	1 58	0 1
25	S	24th Sun. aft. Trin.	7 35	3 58	2 20	1 11
26	M		7 37	3 57	2 40	2 19
27	Tu		7 38	3 56	3 0	3 26
28	W	Sutton's Panoramic Camera pat.	7 40	3 55	3 21	4 32
29	Th	[1859	7 41	3 55	3 45	5 37
30	F	○ 11.7 A.	7 42	3 54	4 12	6 41

Historical notes on many of the above items appear in each issue of THE BRITISH JOURNAL OF PHOTOGRAPHY for 1905.

DECEMBER.

D. M.	D. W.	Remarkable Events.		Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. Morn.	Moon. Sets. After.
1	S	Carl Zeiss d. 1888		7 44	3 52	4 44	7 43
2	S	1st Sun. in Advent.		7 45	3 52	5 22	8 42
3	M			7 47	3 51	6 7	9 36
4	Tu	R. Kennett d. 1896		7 48	3 51	6 59	10 24
5	W	Obernetter's chromo-photo pat. 1864		7 50	3 50	7 57	11 6
6	Th			7 51	3 50	9 0	11 40
7	F			7 52	3 50	10 8	0 a 9
8	S			7 53	3 50	11 18	0 36
9	S	2nd Sun. in Advent.	☾ 1.45 M.	7 55	3 50	Morn	1 0
10	M			7 56	3 49	0 30	1 22
11	Tu	Sir D. Brewster b. 1781		7 57	3 49	1 45	1 46
12	W	Rev. J. B. Reade d. 1870		7 58	3 49	3 3	2 11
13	Th	Poitevin's Photo.-eng. pat. 1855		7 59	3 49	4 25	2 40
14	F	Niepce-Daguerre Partnership 1837		8 0	3 49	5 48	3 16
15	S		● 6.54 A. [1870.	8 1	3 49	7 11	3 59
16	S	H. Greenwood d. 1884. T. Ross d.		8 2	3 49	8 27	4 53
17	M	Claudet's Art Light pat. 1841		8 3	3 49	9 32	5 59
18	Tu			8 3	3 49	10 24	7 13
19	W	Dr. H. W. Vogel d. 1898		8 4	3 50	11 5	8 29
20	Th		☾ 3.4 A.	8 4	3 50	11 37	9 44
21	F			8 5	3 51	0 a 4	10 57
22	S	Wollaston d. 1828		8 5	3 51	0 26	Morn
23	S	4th Sun. in Advent.		8 6	3 52	0 47	0 8
24	M		[b. 1642	8 6	3 52	1 7	1 16
25	Tu	Christmas Day. Sir I. Newton		8 7	3 53	1 28	2 22
26	W			8 7	3 54	1 51	3 28
27	Th			8 8	3 54	2 17	4 33
28	F	J. T. Goddard d. 1866		8 8	3 55	2 46	5 35
29	S			8 8	3 56	3 21	6 35
30	S	J. H. Dallmeyer d. 1883	○ 6.44 A.	8 8	3 56	4 4	7 31
31	M	A. Braun 1877.		8 8	3 57	4 53	8 22

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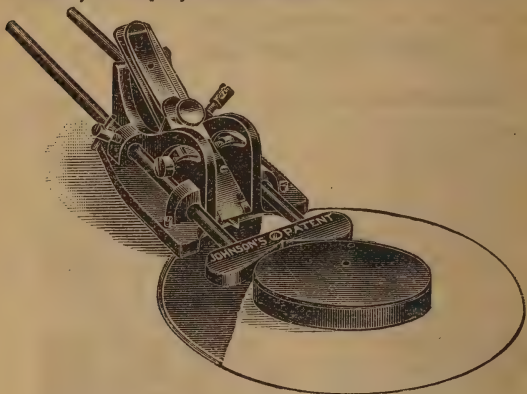

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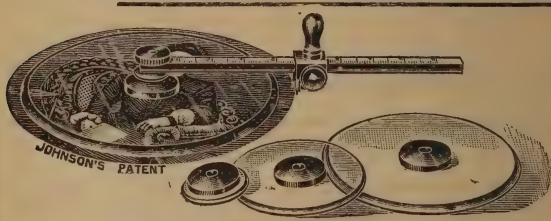

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13 ,, 8	10/0	15/0	1/3
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15 ,, 12	18/0	28/0	2/0
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$2\frac{1}{4}$ in. C	$2\frac{1}{4}$,, $3\frac{1}{4}$	...	1 9	...	0 11
$2\frac{1}{2}$ in.	$2\frac{1}{2}$,, $4\frac{1}{4}$	...	2 6	...	1 3
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4 in.	4 ,, 5	...	3 9	...	1 11
$4\frac{1}{4}$ in.	$4\frac{1}{4}$,, $3\frac{1}{4}$	...	3 0	...	1 6
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18 „ 15	...	12 „	9/6	... ...	6 „	5/0
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$6\frac{1}{2}$,, $4\frac{3}{4}$	...	...	...	16 ,, 1/0
$7\frac{1}{2}$,, 5	...	...	...	12 ,, 1/0
$8\frac{1}{2}$,, $6\frac{1}{2}$	...	...	...	9 ,, 1/0
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PHOTOGRAPHIC SOCIETIES.

PHOTOGRAPHIC SOCIETIES OF THE UNITED KINGDOM.

The following list of British Photographic Societies has been compiled from data supplied by their respective Secretaries, except where so indicated. In these instances no information has been received up to the time of going to press.

* Societies marked with an asterisk are affiliated to the Royal Photographic Society.

*The Royal Photographic Society of Great Britain.

FOUNDED 1853.

Patrons.—His Majesty the King; Her Majesty the Queen.

Vice-Patrons.—H.R.H. the Prince of Wales; H.R.H. the Princess of Wales.

President.—Major-General J. Waterhouse, I.A. (Fellow).

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Meetings.—Held at 66, Russell Square, London, W.C., First, Second, and Fourth Tuesdays October to June ; Third Tuesday November to April.
Annual Exhibition.—September—October, at The New Gallery, 121, Regent Street, London, W.
Secretary and Librarian.—J. McIntosh, 66, Russell Square, London.

Aberdeen Photo Art Club.—*Pres.*, G. L. Smith. *Meetings*, 62, Fonthill Road, Friday, 7.30 p.m. *Sec.*, Miss A. Dalgity, Froghall Cottage, Aberdeen.

Aberdeen Photographic Association.—*Pres.*, James S. Anderson. *Meetings*, 54, St. Nicholas Street, Friday, 8 p.m. *Sec.*, Andrew Gray, 18, South Mount Street.

Aberystwyth Photographic Society.—*Pres.*, Prof. D. Morgan Lewis. *Meetings*, Town Hall, First and Third Fridays in each month, 8 p.m. *Sec.*, F. A. Read, Terrace Road, Aberystwyth.

Accrington Camera Club.—*Pres.*, Dr. Clayton. *Meetings*, Mechanics' Institute. *Sec.*, John B. Holt, 79, Church Street, Church, Lancs.

***Acton and Chiswick Polytechnic Photographic Club.**—*Pres.*, V. C. Egerton. *Meetings*, Polytechnic, Bath Road, Chiswick. *Sec.* Arthur G. Field, 20, Bishopsgate Street Without, City.

Acton Photographic Society.—*Pres.*, Percy Lawrence. *Meetings*, Churchfield Hall, Acton, Second and Fourth Wednesdays October to May, Second Wednesday June to September, 8 p.m. *Sec.*, Eugene Todd, Camden Villa, Churchfield Road, East Acton, W.

Aintree Photographic Society.—*Defunct.*

Airdrie (Monksland) Photographic Society.—*Pres.*, W. B. Hossack. *Meetings*, Victoria Place, Airdrie, Tuesday evenings, October to April. *Sec.*, Jos. Hugginson, Graham Street, Airdrie.

***Aldershot and District Camera Club.**—*Pres.* A. H. Smith. *Meetings*, Masonic Hall, Station Road, First and Third Mondays in the month, 8.30 p.m. *Ex.*, February. *Sec.*, D. Morrison, 88, St. George's Road, Aldershot.

Altrincham Photographic Society.—*Pres.*, D. S. Morrison. *Meetings*, Technical School, Altrincham, First Tuesday in each month, 8 p.m. *Sec.*, H. E. Barwell, 5, Hawthorn Road, Altrincham.

Amateur Photographic Association of Great Britain.—*Defunct.*

Arbroath Amateur Photographic Association.—*Pres.*, George G. Dalgarno. *Meetings*, Y.M.C.A. Rooms, Second and Fourth Tuesdays, 8 p.m. *Sec.*, James Hood, 94, High Street, Arbroath.

*__Architectural Association Camera and Cycling Club.__—*Pres.*, Gilbert H. Lovegrove. *Meetings*, Royal Architectural Museum, 18, Tufton Street, Westminster, S.W., Tuesdays, 8 p.m. *Sec.*, Francis R. Taylor, 34, Hawarden Grove, Herne Hill, S.E.

*__Artists' R.V.__ (20th Middlesex).—*Pres.*, Colonel W. Horsley, V.D. *Meetings*, Headquarters, Dukes Road, Euston Road. *Ex.*, December or January. *Sec.*, Henry W. Fairholme, Blenheim Mansions, Queen Anne's Gate, S.W.

*__Ashton-under-Lyne Photographic Society.__—*Pres.*, Dr. Alex. Hamilton. *Meetings*, Society's Rooms, Henry Square, Ashton-under-Lyne. *Ex.*, February. *Sec.*, Harry Williams, 127, Welbeck Street, Ashton-under-Lyne.

Aston Photographic Society.—*Pres.*, Harold Baker. *Meetings*, Burlington Hall, High Street, Aston, Thursdays, 8 p.m., September to May. *Ex.*, December. *Sec.*, J. C. Taylor, 201, Albert Road, Aston.

Attercliffe Photographic Society.—*Pres.*, F. H. Barnsley. *Meetings*, Friends' Meeting Rooms, Leeds Road, Second Monday of every month. *Ex.*, March, 1906. *Sec.*, George Walton, 57, Ditchingham Road, Sheffield.

Bacup Photographic Society.—*Particulars not received from Secretary.*

*__Balham Camera Club.__—*Meetings*, Masonic Hall, Chestnut Grove, Balham, Thursday, 8.30 p.m. *Sec.*, Wm. R. Bond, 20, Nightingale Square, Balham.

Banbury and District Photographic Society. — *Meetings*, Municipal Technical School, Banbury, First Monday in month, 8 p.m. *Sec.*, Seymour A. Beale, Caerleon, Banbury.

Barnstaple Y.M.C A. Camera Club.—*Pres.*, G. M. Pitt. *Meetings*, Y.M.C.A., High Street, First Tuesday in the month. 8.15 p.m. *Secs.*, W. K. Massey, 16, Sticklepath, and A. Copp, Boutport Street.

Barrhead and District Amateur Art Club.—*Pres.*, Dr. Robert Corbett. *Meetings*, Kelburn Street Studio, Barrhead, last Monday of month, 8 p.m. *Ex.*, April. *Secs.*, R. Murray and J. McGrouther, 146, Main Street, Barrhead.

Barrow Naturalists' Field Club (Photographic Section).—*Pres.*, J.W. Osborne. *Meetings*, Cambridge Hall, St. George's Square, Tuesdays, 8 p.m. *Sec.*, James Frankland, 8, Greengate, Barrow-in-Furness.

Bath Y.M.C.A. Camera Club.—*Pres.*. W. Pitt. *Meetings*, Broad Street, Bath, Thursday evenings. *Secs.*, W. J. Hallett and Fred. Stone, Y.M.C.A., Broad Street, Bath.

Batley and District Photographic Society.—*Pres.*, W. Hemingway, M.A. *Meetings*, Technical Schools, Batley, Thursdays, 8 p.m. *Secs.*, W. H. Atkinson and C. H. Giggal, Cemetery Lodge, Batley.

Belfast Queen's College Camera Club.—*Pres.*, John Wylie, B.A. *Meetings*, Students' Union, Queen's College, generally Second Tuesday in month, 8 p.m. *Sec.*, J. D. M. McCallum, Students' Union, Queen's College, Belfast.

Belfast Y.M.C.A. Camera Club.—*Pres.*, R. G. Moffet. *Meetings*, Y.M.C.A., Wellington Place, Belfast, First Tuesday in each month, 8 p.m. *Sec.*, David James Hogg, Y.M.C.A., Wellington Place, Belfast.

Beverley Photographic and Sketching Society.—*Particulars not received from Secretary.*

Bideford Camera Club.—*Pres.*, W. H. Thorndon. *Meetings*, Bridge Buildings, Tuesdays, 8 p.m. *Ex.*, December. *Sec.*, P. Bamberger, 15, Chingswell Street, Bideford, North Devon.

***Birkenhead Photographic Association.**—*Pres.*, R. J. Russell, T.C. *Meetings*, Young Men's Christian Association, Grange Road, Fridays, 8 p.m., from October to March. *Ex.*, January 8, 1906. *Sec.*, J. T. Peters, 62, Westbourne Road.

Birmingham Natural History and Philosophical Society.—*Particulars not received from Secretary.*

***Birmingham Photographic Society.**—*Pres.*, Howard J. Collins. *Meetings*, Norwich Union Chambers, Congreve Street, Tuesdays, 7.30 p.m. *Ex.*, February–March. *Sec.*, Lewis Lloyd, Norwich Union Chambers, Congreve Street, Birmingham.

***Bishop Auckland Photographic Society.**—*Pres.*, J. W. Athey. *Meetings*, 11, Silver Street, open daily. *Ex.*, March. *Sec.*, Geo. Ross, Cemetery Lodge, Bishop Auckland.

Blackburn and District Photographic Society.—*Pres.*, Richard Wolstenholme. *Meetings*, 6, Sudell Cross, Tuesdays and Thursdays, 8 p.m. *Sec.*, Wilfrid Duxbury, Apsley House, Gawthorpe, Blackburn, Lancs.

Blackburn Camera Club.—*Meetings*, 29, Church Street, Blackburn. *Sec.*, A. N. Brand.

Blairgowrie and District Photographic Association.—*Pres.*, Alexander Geekie. *Meetings*, George Street, Blairgowrie, Third Tuesday of month, September to May, 8.15 p.m. *Sec.*, Lake Falconer, Jun., James Street Cottage, Blairgowrie.

Blaydon and District Camera Club.—*Particulars not received from Secretary.*

Bognor Photographic Society.—*Particulars not received from Secretary.*

***Bolton Amateur Photographic Society.**—*Particulars not received from Secretary.*

Bolton Photographic Society.—*Sec.*, C. K. Dalton, 50, Higher Bridge Street, Bolton.

Bonnybridge Amateur Photographic Association.—*Pres.*, G. A. Ure *Meetings*, Foundry Hall, Second Friday of each month, at 8 p.m. *Ex.*, Triennial (last held 1904). *Sec.*, William Lapsley, Spencer Cottage, Bonnybridge.

Bootle Photographic Society.—*Pres.*, Ald. W. R. Brewster, J.P. *Meetings*, 324, Stanley Road, Bootle, Tuesday, 8 p.m. *Ex.*, December. *Sec.*, W. E. Parry, 31, Browne Street, Bootle.

Bootle St. Matthew's Camera Club.—*Pres.*, Rev. W. Harry Roberts, M.A. *Meetings*, Parochial Hall (St. Matthew's Church), Tuesday, 8 p.m. *Ex.*, November. *Sec.*, Harold Tempest, 78, Thornton Road, Bootle, Liverpool.

***Borough Polytechnic Photographic Society.** — *Pres.*, A. Bedding. *Meetings*, Borough Polytechnic Institute, Borough Road, S.E., Wednesday 8.15 p.m., Friday 8.30 p.m. *Ex.*, March. *Secs.* (*joint*), G. W. Francis and G. Wynne, 103, Borough Road, S.E.

Boston Camera Club.—*Pres.*, Dr. C. W. Pilcher. *Meetings*, St. James' Schools, George Street, First and Third Tuesday October to April, First Tuesday other months. *Ex.*, January 11, 12, 13, 1906. *Secs.*, H. M. Hames and R. W. Halliday, 65, West Street, Boston.

*Bowes Park and District Photographic Society.—*Pres.*, R. Core-Gardner, C.P.A., M.S.A. *Meetings*, Unity Hall, Newnham Road, Wood Green, N., First and Third Mondays, 8 p.m. *Ex.*, February 22, 23, 24, 1906. *Sec.*, Henry C. Bird, 91, Whittington Road, Bowes Park, N.

Bradford Photographic Society.—*Pres.*, G. A. Bever. *Meetings*, Grammar School, Monday, 8 p.m. *Sec.*, Harry Akam, 25, Clarendon Terrace, Bradford.

Braintree and Bocking Camera Club.—*Pres.*, E. B. Knobel. *Meetings*, The Institute, Braintree, every other Tuesday, Winter months, 8 p.m. *Sec.*, W. H. Tilston, 81, High Street, Braintree.

Brechin Photographic Association.—*Pres.*, Wm. Shaw Adamson *Meetings*, Rooms, 14, St. Mary Street, Third Wednesday each month, 8.15 p.m. *Sec.*, John M. Dunn, Bank Street, Brechin.

*Brentford Photographic Society.—*Pres.*, Rev. T. Eland, M.A., F.R.G.S. *Chairman*, Hilton Grundy. *Meetings*, Lecture Room, Brentford Free Public Library, First and Third Tuesdays in month, 8.15 p.m. *Ex.*, March. *Sec.*, Frank H. Read, "Ferndale," Clifton Road, Brentford.

*Brierley Hill Camera Club.—*Pres.*, Owen Gibbons, C.C. *Meetings*, Technical School, Brierley Hill, Wednesdays, October to March, 8 p.m. *Ex.*, January. *Sec.*, J. Thomas, William Street, Brierley Hill.

Brighouse Photographic Society.—*Pres.*, Dr. George A. Farrer. *Meetings*, The Studio, Town Hall Buildings, Thursday evenings, 8 p.m. *Secs.*, F. W. Crowther, 11, Anvil Street, and H. Robinson, 13, Lee Street.

Bristol and West of England Amateur Photographic Association.—*Pres.*, H. A. Hood-Daniel. *Meetings*, Berkeley Square, Clifton, Bristol, Second and Fourth Fridays, 7.30 p.m. *Sec.*, Guy Chilton, 34, Baldwin Street, Bristol.

Bristol Photographic Club.—*Pres.*, John Fisher, Hon. A.R.C.A. *Meetings*, Y.M.C.A. Rooms, St. James', Bristol, alternate Tuesdays, 8 p.m. *Sec.*, Wm. Wallace Smith, 62, Sefton Park Road, Ashley Down, Bristol.

*Bromley (Kent) Camera Club.—*Pres.*, John Scott, B.A., M.B *Meetings*, Co-operative Hall, East Street, Bromley, Kent, Friday, 8 p.m. *Sec.*, Ernest W. Andrew, 90, College Road, Bromley, Kent.

***Burnley Camera Club.**—*Pres.*, Geo. Chester Ogden. *Meetings.* Mechanics' Institute, Thursday, 7.45 p.m. *Ex.*, November. *Sec.*, F. Pinder, Mechanics' Institute, Burnley.

Burton-on-Trent and Y.M.C.A. Photographic Society.—*Particulars not received from Secretary.*

Burton-on-Trent Archæological Society (Photographic Society.)—*Pres.*, W. Howarth. *Meetings*, High Street, Burton-on-Trent, Second Tuesday in each month, 8 p.m. *Sec.*, A. R. Wheatley, M.P.S., 22, High Street, Burton-on-Trent.

Bury Athenæum Amateur Photographic Society.—*Particulars not received from Secretary.*

***Bury St. Edmunds Camera Club.**—*Pres.*, Mrs. Manson. *Meetings*, Masonic Hall, Chequer Square, Bury St. Edmunds, First Wednesday in each month, 9 p.m. *Sec.*, Owen A. Clark, 12, Abbeygate Street, Bury St. Edmunds.

***Cambridge and District Photographic Club.**—*Pres.*, F. J. Stoakley. *Meetings*, 1, Prince of Wales's Passage, Second and Fourth Tuesday in each month, 8.30 p.m. *Ex.*, October and November. *Sec.*, T. J. Sowdon, "Sunny Side," Guest Road, Cambridge.

Cambridge Y.M.C.A. Camera Club.—*Pres.*, F. W. Bird. *Meetings*, Alexandra Hall, Cambridge, Wednesday, 8.30 p.m., October to March. *Sec.*, Jno. Johnson, 3, St. Andrew's Street, Cambridge.

Camera Club (Charing Cross Road, London). — Amalgamated August, 1905, with the Blenheim Club, 12, St. James' Square, London, W. *Sec.*, Montague Gipps, at this address.

***Cardiff Photographic Society.**—*Pres.*, Daniel Lill. *Meetings*, 7 and 8, Working Street, Friday, 8 p.m. *Ex.*, January. *Secs.*, R. C. and A. E. Harris, 3, Queen Street Arcade, Cardiff.

***Cardiff Windsor Amateur Photographic Society.**—*Pres.*, Frederick Fox. *Meetings*, 17a, Quay Street, Cardiff, Tuesday and Thursday in each week, 8 p.m. *Ex.*, February. *Sec.*, W. A. Woodward, 189, Mackintosh Place, Cardiff.

Cardiff Y.M.C.A. Camera Club.—*Pres.*, Dr. De Vere Hunt. *Meetings*, Association Rooms, Station Terrace, Tuesday, 8 p.m. *Sec.*, John H. Compton Hunt, 15, Romilly Crescent, Cardiff.

***Carlisle Border City Camera Club.**—*Pres.*, Earl of Selby. *Meetings*, Lecture Room, Liberal Club, Lowther Street, every alternate Tuesday, 8 p.m. *Sec.*, Geo. H. Hill, 45, Collingwood Street, Carlisle.

***Carlisle and County Amateur Photographic Society.**—*Pres.*, R. M. Lidbetter. *Meetings*, Tullie House Art Gallery, Carlisle, Wednesdays (fortnightly), 8 p.m. *Sec.*, Samuel W. B. Jack, The Studio, Greystone Road, Carlisle.

Carluke Photographic Association.—*Pres.*, Richard Chalmers. *Meetings*, Rooms, Clyde Street, every Wednesday, 8 p.m. *Sec.*, Andrew Fraser, Clyde Street, Carluke.

Carnoustie Photographic Association. — *Pres.*, A. Heggie. *Meetings*, Carnoustie Y.M.C.A. Rooms, Second Monday in each month, 8 p.m. *Sec.*, C. Wade, Zoar Lodge, Barry Road, Carnoustie.

Caterham Institute Camera Club.—*Pres.*, C. E. Kenneth Mees, B.Sc., F.C.S. *Meetings*, Caterham Institute, Monday, 8.30 p.m. *Ex.*, November. *Sec.*, J. C. Scrivener, Mistleigh, Caterham Valley.

***Catford and Forest Hill Photographic Society.**—*Pres.*, Major E. F. Coates, M.P. *Meetings*, Sydenham, First and Third Mondays, 8.30 p.m. *Ex.*, end of February. *Sec.*, William Theyer Browne, 169, Woolstone Road, Forest Hill, S.E.

Central Photographic Society.—*Pres.*, Rev. F. C. Lambert, M.A. *Meetings*, Exeter Hall, Strand, W.C., Wednesday evenings, 7.30. *Sec.*, H. J. Lewis, Exeter Hall, Strand, W.C.

***Chelsea and District Photographic Society.**—*Pres.*, Emslie J. Horniman, L.C.C. *Meetings*, South Western Polytechnic, Manresa Road, Chelsea. *Sec.*, F. Webb, 175, Fulham Road, London, S.W.

***Cheltenham Amateur Photographic Society.**—*Particular received from Secretary.*

***Chester Society of Natural Science and Art** (Photographic Section).—*Pres.*, Dr. Stolterforth, M A., J.P. *Meetings*, Grosvenor Museum, First and Third Fridays in each month. *Ex.*, March. *Sec.*, Frank Simpson, 10, Grosvenor Street, Chester

Chichester Photographic Society.—*Pres.*, F. B. Tompkins. *Meetings*, Technical Institute, Second Tuesday in each month, Winter; Second Thursday in each month, Summer. *Sec.*, G. M. Turnbull, J P., Lyndhurst Lodge, Chichester.

*Chiswick Camera Club.—*Pres.*, R. P. Drage. *Meetings*, Devonshire Room, Town Hall, Chiswick, Tuesday evenings, October to March, 8.15 p.m. *Ex.*, April 9 and 10. *Sec.*, J. Mann, 9, Cambridge Road, Chiswick.

Chorley Photographic Society.—*Pres.*, H. N. Whittle. *Meetings*, Club Rooms, Devonshire Road, Second Wednesday in each month. *Ex.*, March. *Secs.*, J. R. Waring, 12, Bank Street, Chorley, and H. R. Dorning, M.P.S., 8, Pall Mall, Chorley.

*City and Guilds of London Technical College, Finsbury, Photographic Society.—*Pres.*, Prof. R. Meldola, F.R.S. F.I.C., F.C.S. *Meetings*, Technical College, Finsbury, alternate Tuesdays, 4 p.m. *Ex.*, June. *Sec.*, W. G. Rowse, 172–174, Bethnal Green Road, E.

Cleveland Camera Club.—*Pres.*, J. J. Burton. *Meetings*, Literary and Philosophical Institution, Corporation Road, Middlesbrough, 7.30 p.m. on alternate Mondays. *Ex.*, February, 1906. *Sec.*, Fred W. Pearson, 182, Abingdon Road, Middlesbrough.

Coatbridge Photographic Society.—*Particulars not received from Secretary.*

Coatbridge Photographic Association.—*Pres.*, J. B. Bell. *Meetings*, Photographic Institute, Wood Street, First and Third Thursday, 8 p.m. *Ex.*, December. *Sec.*, Geo. W. Campbell, Ailsa Cottage, Coatbridge.

Coatbridge Co-operative Camera Club.—*Pres.*, Mitchell Suttie. *Meetings*, Library Hall, Dunbeth Road, Coatbridge, every alternate Monday, 8 p.m. *Ex.*, April. *Sec.*, James Robb, 6, Lefroy Street, Coatbridge.

Colne Camera Club.—*Pres.*, Ald. Hewitt. *Meetings*, Cloth Hall, Walton Street, Friday, 8 p.m. *Sec.*, John J. Hartley, Craven Bank House, Colne.

Consett and District Photographic Society.—*Pres.*, Captain Petherick. *Meetings*, Club Rooms, Luton House, Consett, Wednesday and Saturday, 8 p.m. *Sec.*, Peter E. Surtees, Viewdale, Mount Pleasant, Consett.

*Cornish Camera Club.—*Pres.*, R. Pearce Couch. *Meetings*, The Studio, Penzance, First and Last Tuesdays in each month. *Sec.*, H. Tonkin 22, Market Place, Penzance.

Cornwall Central Photographic Club.—*Pres.*, Professor James Clark, M.A., D.Sc., A.R.C.S. *Meetings*, Central Technical Schools for Cornwall, Thursdays, 8 p.m. *Sec.*, Alex. Gregg, 5, Adelaide Terrace, Truro.

*Coventry Photographic Society.—*Pres.*, H. D. Waters. *Meetings*, Club Rooms, 7, Little Park Street, Wednesday evenings, 8, p.m. *Ex.*, March 15, 16, and 17. *Sec.*, W. H. McLauchlan, 5, Chester Street, Coventry.

*Cricklewood Photographic Society. — *Pres.*, J. Stevenson. *Meetings*, 89, Cricklewood Broadway, Cricklewood, N.W., Wednesday, 8 p.m. *Sec.*, Wilfrid Emery, 89, Cricklewood Broadway, N.W.

Crieff Photographic Association.—*Pres*. J. B. Whitelaw. *Meetings*, Cornton Place, Third Wednesday 8.30 p.m. *Sec.*, Wm. Forbes, Drummond House, Crieff.

*Cripplegate Photographic Society.—*Pres.*, Chairman of the Cripplegate Foundation. *Meetings*, Cripplegate Institute, Golden Lane, E.C., Second and Fourth Mondays, 7.30 p.m. *Sec.*, John B. Parnham, 5, Reighton Road, Upper Clapton, N.E.

Cromer and District Photographic Society.—*Pres.*, David Dulley. *Meetings*, Jessop's Room, High Street, Cromer, First and Third Monday, 8 p.m. *Sec.*, Cyril J. C. Goodyear, Heath House, Cromer.

Crompton Camera Club.—*Pres.*, James H. Broadbelt. *Meetings*, Blue Bell Hotel, Shaw, every alternate Wednesday, 8 p.m. *Ex.*, November. *Sec.*, Henry Illingworth, 22, Horton Street, Shaw, Lancashire.

Crook and District Camera Club,—*Pres.*, W. L. Powell. *Meetings*, J. G. Gowland's Studio, Church Street, Crook, every alternate Wednesday in Winter, and every alternate Tuesday in Summer. *Sec.*, Edward Lloyd, Iveston House, Crook, co. Durham

*Croydon Camera Club.—*Pres.*, W. H. Smith. *Meetings*, 128a, George Street, Croydon, Wednesday, 8 p.m. *Ex.*, November. *Sec.*, Henry M. Bennett, "Alipore," Duppas Hill, Croydon.

*Croydon Natural History and Scientific Society.—*Pres.*, W. F. Stanley, F.G.S., etc. *Meetings.*, Old School of Art Room, Public Hall, Croydon. *Sec.*, G. W. Moore, Bryndhurst, 15, Dornton Road, South Croydon.

Croydon Natural History and Scientific Society (Photographic Section). — *Pres.*, W. F. Stanley, F.G.S., F.R.A.S. *Meetings*, Public Hall, Croydon, Fourth Wednesday in month, 8 p.m. *Sec.*, J. G. Lincoln, 1, High Street, Croydon.

Darlington Camera Club.—*Pres.*, Chas. J. Barthorpe. *Meetings*, Assembly Hall, Darlington, Tuesday, 8 p.m., from October to March. *Sec.*, Harold L. Thomson, 9, Close Street, Darlington.

Darwen Photographic Association.—*Pres.*, Geo. Butterworth. *Meetings*, Belgrave Schools, Thursday, 8 p.m. *Secs.*, F. Dearnley, 52, Ellison Fold Terrace, Darwen, and J. Wild, 14, Sandon Street, Darwen.

***Davos Amateur Photographic Society.**—*Pres.*, Fred. W. Burt. *Meetings*, Belvedere Hotel, Davos, Switzerland, Fortnightly, First and Third Wednesdays, November to March. *Ex.*, February. *Sec.*, Charles S. Kershaw, Belvedere, Davos, and 18, Bisham Gardens, Highgate, N.

Deal and Walmer Camera Club.—*Meetings*, Blackburn Institute, alternate Wednesdays, at 7.30 p.m. *Sec.*, J. Turk, 73, College Road, Deal.

***Derby Photographic Society.**—*Pres.*, E. Collier Green, M.R.C.S Eng., L.R.C.P. Lond. *Meetings*, Messrs. Cumberland's, The Wardwick, Second Tuesday in month, 8 p.m. *Sec.*, A. H. Bennett, 13, Wilfred Street, Derby.

***Devonport Camera Club.**—*Pres.*, W. Treglohan, B.A. *Meetings*, The Technical School, Devonport, alternate Wednesdays, 8 p.m. *Sec.*, Alfred J. Catford, 33, Neath Road, Plymouth.

Dewsbury and District Amateur Photographic Society.—*Pres.*, Herbert Day. *Meetings*, Law Society's Rooms, Bond Street, Dewsbury, Monday, 8 p.m., from October to end of March. *Ex.*, March 26, 1906. *Sec.*, Joseph Garside, 45, Healds Road, Dewsbury.

***Doncaster Camera Club.**—*Pres.*, Patrick Stirling. *Meetings*, The Albany Hotel, Second and Fourth Tuesdays in each month. *Ex.*, March 7 and 8, 1906. *Sec.*, T. Haigh Connor, 39, Market Place, Doncaster.

Dover Institute Photographic Society.—*Pres.*, T. A. Terson, J.P. *Meetings*, The Dover Institute, Biggin Street, Second and Fourth Thursday, 8 p.m. *Ex.*, January. *Sec.*, H. Plowright, 47, Maison Dieu Road, Dover.

Dukinfield Photographic Society.—*Pres.*, J. T. Lees. *Meetings*, Co-operative Hall, Dukinfield, every Wednesday; monthly meeting, first Wednesday, 8 p.m. *Ex.*, February. *Sec.*, Hy. L. Hadfield, 107, King Street, Dukinfield.

"**Dundee Advertiser" Photographic Club.** — *Pres.*, John Macrae. *Meetings*, Bank Street, Dundee. *Sec.*, J. L. Scott, 94, Commercial Street, Dundee.

***Dundee and East of Scotland Photographic Association.**—*Pres.*, G. D. Macdougald, F.I.C. *Meetings*, University College, Dundee, First Thursday, November to May (except January, Second Thursday), 7.30 p.m. *Sec.*, V. C. Baird, Broughty Ferry.

Durham City Camera Club.—*Particulars not received from Secretary.*

***Ealing Photographic Society.**—*Pres.*, J. Watson. *Meetings*, Town Hall, Ealing, First and Third Wednesdays, October to March inclusive, 8 p.m. *Ex.*, April 5, 1906. *Sec.*, Sydney Taylor, 38, Hamilton Road, Ealing.

***Eastbourne Natural History Society** (Photographic Section). *Pres.*, J. J. Hollway. *Meetings*, Technical Institute, Eastbourne, Third Monday in the month, 8.15 p.m. *Sec.*, Frank Ash, B.Sc., Rosemead, Mayfield Place, Eastbourne.

***East Kent Scientific and Photographic Society.**—*Pres.*, S. Harvey, F.I.C., F.C.S. *Meetings*, Beaney Institute, alternate Tuesday evenings. *Sec.*, A. Lander, Ph.C., F.S.M.C., The Medical Hall, Canterbury.

Eccles Photographic Society.—*Pres.*, D. Lawton. *Meetings*, 18, Peel Street, Eccles, First and Third Tuesday in each month, 8 p.m. *Ex.*, March. *Sec.*, C. A. Oldham, Gladstone Road, Eccles.

Edinburgh Photographic Club. — *Pres.*, Andrew H. Baird. *Meetings*, 38, Castle Street, Edinburgh, Third Wednesday in each month, 8 p.m. *Sec.*, T. Barclay, 180, Dalkeith Road, Edinburgh.

***Edinburgh Photographic Society.**—*Pres.*, J. Tudor Cundall, B.Sc. (Lond.). *Meetings*, 38, Castle Street, Edinburgh, First, Second, and Fourth Wednesdays, October to June. *Ex.*, February 24 to March 10, 1906. *Sec.*, J. S. M'Culloch, W.S., 3a, North St. David Street, Edinburgh.

Edinburgh University Photographic Society.—*Pres.*, Dr. Drinkwater. *Meetings*, University Union, Edinburgh. *Ex.*, November. *Sec.*, Harold C. Simpson, University Union, Edinburgh.

***Edmonton and District Photographic Society.**—*Meetings*, Brettenham Road School, Upper Edmonton, Wednesdays, 8 p.m. *Sec.*, Stephen J. Solly, "Westleigh," Silver Street, Upper Edmonton.

Enfield Junior Social Club (Photographic Section).—*Particulars not received from Secretary.*

Erdington Photographic Society.—*Pres.*, Councillor W. Smedley Aston. *Meetings*, Public Hall, Erdington, near Birmingham, Monday, 8 p.m. *Ex.*, October. *Sec.*, Thos. A. Sands, 26, Frederick Road, Gravelly Hill, Birmingham.

Erith and District Photographic Society.—*Pres.*, A. W. Goodman. *Meetings*, J. B. Major's Rooms, Park Crescent Road, Erith, First and Third Mondays in month, 8 p.m. *Sec.*, J. B. Major, 24, Pier Road, Erith.

Everton Camera Club.—*Pres.*, O. B Stonehouse. *Meetings*, 14, Village Street, Everton, alternate Wednesdays, 8 p.m. *Sec.*, W. Tansley, 22, Chapel Place, Liverpool.

Evesham Camera Club.—*Pres.*, O. G. Knapp. *Meetings*, Public Library. *Sec.*, R. C. Mawson, 3, Victoria Avenue, Evesham.

***Fakenham Literary Field and Camera Club.** — *Pres.*, Algernon Digby, M.A. *Meetings*, The Lancaster Rooms, Fakenham. *Sec.*, Henry Newson, The Square, Fakenham, Norfolk.

Falkirk Amateur Photographic Association. — *Pres.*, John Higgins. *Meetings*, Club Room, Newmarket Street, Falkirk, last Thursday of month. *Sec.*, W. M. Clark, 10, Meeks Road, Grahamston, Falkirk.

Frome Mechanics' Institute Photographic Society.—*Defunct.*

Fulham Camera Club.—*Defunct.*

***Gateshead Camera Club.**—*Pres.*, A. B. Gardiner. *Meetings*, Mechanics' Institute, West Street, Gateshead-on-Tyne, Tuesday, 8 p.m. *Sec.*, Thomas Miller, 162, Beaconsfield Terrace, Prince Consort Road, Gateshead-on-Tyne.

***Gillingham (Kent) and District Amateur Photographic Society.**—*Pres.*, J. R. Featherby, J.P. *Meetings*, Second and Fourth Wednesdays in month, 8 p.m. *Sec.*, Hy. Hill, 173, Balmoral Road, Gillingham, Kent.

Glasgow and West of Scotland Amateur Photographic Association.—*Pres.*, Robert Burnie. *Meetings*, Rooms of the Association, 180, West Regent Street, Glasgow, Monday, 8 p.m. *Ex.*, February. *Sec.*, Wm. Goodwin, 3, Lynedoch Street.

Glasgow Eastern Amateur Photographic Association.—*Pres.*, W. S. Crocket. *Meetings*, 12a, Landressy Street, Glasgow, Thursday, 8 p.m. *Ex.*, November—December. *Secs.*, T. B. Kirkhope, 37, Winston Street, Parkhead, Glasgow, and A. Taylor, 1126, Cathcart Road, Mount Florida, Glasgow.

Glasgow Eastern Co-operative Camera Club.—*Pres.*, David H. Knight. *Meetings*, 4, Sword Street, Glasgow, Fridays, 8 p.m. *Ex.*, February 16, 1906. *Sec.*, Robert Colquhoun, 116, George Street, Glasgow.

Glasgow Southern Photographic Association.—*Pres.*, W. S. Morren. *Meetings*, 1, Eglinton Lane, S.S., Glasgow, Tuesdays (weekly), 8 p.m.; beginners' and informal meetings, Thursday, *Ex.*, March 6 to 20, 1906. *Sec.*, Wm. A. Frame, 28, Bank Street. Hillhead, Glasgow.

Glenalmond Photographic Club.—*Pres.*, Arthur S. Reid, M.A., F.G.S. *Meetings*, Trinity College, Glenalmond, alternate Saturdays during College Terms, 9 p.m. *Ex.*, July. *Sec.*, c/o A. S. Reid, Trinity College, Glenalmond.

***Gloucestershire Photographic Society.**—*Pres.*, G. Sheffield Blakeway. *Meetings*, Municipal Schools of Science and Art, alternate Tuesday evenings in Winter. *Secs.*, Edward A. Ind, 36, Northgate, and S. A. Pitcher, College Court.

Glossop Y.M.C.A. Photographic Society.—*Pres.*, S. Hill Wood, J.P., D.L. *Meetings*, Y.M.C.A. Rooms, Victoria Street, Glossop, Second Tuesday in the month, 8 p.m. *Sec.*, T. W. Sharpe, 85, Primrose Terrace, Glossop.

Grangemouth Amateur Photographic Association. — *Pres.*, James P. Mackenzie. *Meetings*, Lumley Street (Photographic Rooms), First Monday of every month. *Ex.*, October. *Sec.*, Robert Marshall, 3, Park Terrace, Grangemouth.

Grantham and District. — *Pres.*, Rev. Clement Elsmere, M.A. *Meetings*, Exchange Hall, Grantham. *Ex.*, January. *Sec.*, Geo. Jackson, Launder Terrace, Grantham.

Graphic Society.—*Pres.*, G. F. Treleaven. *Sec.*, J. S. Hawker, Mutley House, Plymouth.

Gravesend Camera Club.—*Pres.*, Sir Gilbert Parker, M.P. *Sec.*, G. Bitton Porter, 158, Parrock Street, Gravesend.

Gravesend and District Photographic Society.—*Pres.*, Bernard Bishop. *Meetings*, Medical Hall Rooms, Second and Fourth Monday of the month. *Ex.*, January. *Sec.*, Thos. L. Winnett, 155, Milton Road.

***Great Western Railway Literary Society** (Photographic Section).—*Pres.*, Col. the Hon. C. E. Edgcumbe. *Meetings*, 44, East-

bourne Terrace, every Second Monday, 6 p.m. *Sec.*, F. W. Chubb, Surveyors' and Estate Office, Paddington Station.

***Great Yarmouth and District Camera Club.**—*Pres.*, Dr. A. H. Meadows. *Meetings*, 156. King Street. alternate Tuesdays during Winter months. *Sec.*, J. Shearman, 156, King Street, Great Yarmouth.

Greenock Camera Club.—*Pres.*, Thomas Rowley. *Meetings*, 12, Princes Street, Greenock, Thursdays, 8 p.m. *Ex.*, February 13 to 27, 1906. *Sec.*, R. A. D. Macalister, 39, Kelly Street, Greenock

Guild, The, Leeds.—*Sec.*, R. Stockdale, 17, Mount Preston, Leeds.

Guisbrough Fine Art and Industrial Society.—*Pres.*, Wm. Charlton, M.E. *Meetings*, Temperance Hall. *Ex.*, February. *Sec.*, George Page, 34, Westgate, Guisbrough, Yorks.

***Guy's Hospital Nurses' Photographic Society.**—*Pres.*, Miss S. A. Swift, Matron Guy's Hospital. *Meetings*, Nurses' Home, Guy's Hospital, S.E., Wednesdays, 8.15 p.m. *Ex.*, March *Sec.*, Miss M. Smith, Guy's Hospital, S.E.

***Hackney Photographic Society.** — *Pres.*, Harold W. Lane. *Meetings*, The Pembury Hotel, Amhurst Road, Hackney. Tuesdays, 8 p.m. *Ex.*, November. *Sec.*, Walter Selfe, 70, Paragon Road, Hackney.

Halifax Camera Club. — *Pres.*, J. Ingham Learoyd. *Meetings*, 29, Northgate, Halifax, Monday or Tuesday, 8 p.m. *Sec.*, Lionel Dickinson, 113, Athol Mount, Ovenden, Yorks.

Haltwhistle Photographic Society.—*Pres.*, Dr. W. R. Speirs. *Sec.*, D. Macadam, Haltwhistle.

Hamilton Photographic Society.—*Pres.*, Thos. Haldane. *Meetings*, Y.M.C. Institute, Hamilton. *Ex.*, February. *Sec.*, Joseph Murdoch, Selkirk Street, Hamilton.

***Hampstead Scientific Society** (Photographic Section).—*Pres.*, Sir Samuel Wilks, Bart., M.D., LL.D., F.R.S. *Meetings*, Stanfield House, Prince Arthur Road, Hampstead, Wednesday and Friday alternately, 8.30 p.m. *Ex.*, December. *Sec.*, H. Nevil Smart, 40, Compayne Gardens, West Hampstead.

Handsworth Photographic Society.—*Pres.*, Philip Whitehouse. *Meetings*, 111, Soho Road, Handsworth, Thursday, 8 p.m. *Ex.*, May. *Sec.*, A. E. Teague, 51, Linwood Road, Handsworth, Birmingham.

Harrogate Camera Club.—*Pres.*, Riley Fortune, F.Z.S. *Meetings*, Lecture Room, "Builder's Exchange," Thursdays weekly, 8 p.m. *Sec.*, Sam B. Lupton, Prospect Crescent.

Hartford Camera Club.—*Pres.*, Frederic M. Crossfield, M.D. *Meetings*, Cheney Buildings (Club Rooms), Hartford, Second and Fourth Tuesdays, 8 p.m. *Ex.*, April and November. *Sec.*, Clayton P. Chamberlin, c/o "Hartford Times."

*__Hartlepools' Photographic and Sketching Society.__—*Pres.*, F. Yeoman, J.P. *Meetings*, Municipal Technical College, West Hartlepool, alternate Wednesdays, commencing October 4, 7.30 p.m. *Ex.*, January, 1906. *Sec.*, Jas. J. Rutherford, 52, Milton Road, West Hartlepool.

*__Hastings and St. Leonards Photographic Society.__—*Pres.*, R. White-Ford, J.P. *Meetings*, Public Hall, Hastings, Second Thursday and Fourth Monday in each month, 8.15 p.m. *Sec.*, Hubert Walter, "Llanstephan," Fearon Road, Hastings.

Heaton Amateur Photographic Society.—*Defunct.*

Heaton and District Camera Club (Newcastle-on-Tyne).—*Pres.*, Dr. A. Campbell. *Meetings*, Victoria Hotel, Heaton Road, every alternate Monday from October 9 to April 2. *Sec.*, George C. Urwin, 31, First Avenue, Heaton, Newcastle-on-Tyne.

*__Hemel Hempstead and District Photographic Society.__—*Pres.*, Rev. E. J. Gallop, M.A. *Meetings*, Oxford Club Home, Marlowes, Hemel Hempstead, Thursdays, 8 p.m. *Sec.*, Robert R. Gurney, Boxmoor Wharf, Hemel Hempstead.

Herefordshire Photographic Society.—*Pres.*, J. S. Arkwright, M.P. *Meetings*, Clarence House, West Street, Hereford, Wednesday, 8 p.m. *Sec.*, Cecil Gethen, 9, St. Nicholas Street, Hereford.

*__Hillsbro' District Photographic Society.__—*Pres.*, Z. Carr. *Meetings*, Makin's School, Beechwood Road, Hillsbro', Second Wednesday in each month. *Sec.*, C. Helliwell, High Matlock, Stannington, near Sheffield.

Holmfirth Photographic Society.—*Pres.*, Dr. Williams. *Meetings*, Holmfirth Technical Institute, Tuesday, monthly, 8 p.m. *Ex.*, December. *Sec.*, Frederick Bertram Shaw, Shaley Top, Holmfirth.

Hornsey St. Luke's Photographic Society.—*Pres.*, Rev. F. Ealand. *Meetings*, St. Luke's Parish Hall, Mayfield Road, Hornsey, Second Thursday in each month, 8 p.m. *Sec.*, S. Jones, 76, Ferme Park Road.

*Hove Camera Club.—*Pres.*, Alderman J. Colman, J.P. *Meetings*, Club Rooms, 55, Western Road, Hove, Tuesday, twice a month, October to April. *Ex.*, December. *Sec.*, A. R. Sargeant, 55, The Drive, Hove.

Huddersfield Naturalist and Photographic Society.—*Pres.*, J. H. Carter. *Meetings*, Technical College, Queen Street South, Wednesday, 7.30 p.m. *Sec.*, George James Mackenzie Wicker, 7, John William Street, Huddersfield.

Hull Photographic Society.—*Pres.*, G. F. Bristow, Jun. *Meetings*, Grey Street, Hull, Thursday, 8 p.m. *Ex.*, December. *Sec.*, A. E. Hindson, 104, Blenheim Street, Hull.

*Ibis Camera Club.—*Pres.*, Sir Henry Harben. *Meetings*, 142, Holborn Bars, London, E.C. *Sec.*, W. H. Coleman, Battlefield Road, St. Albans.

*Ilford and District Photographic Society.—*Pres.*, Arthur R. Mann. *Meetings*, Cranbrook College, Cranbrook Road, Ilford, Monday, 8 p.m., every week during Winter. *Sec.*, G. Edw. Lyddon, 3, Belgrave Road, Ilford.

Ilkeston Arts Club (Photographic Section).—*Pres.*, Ald. R. Hunt, C.C. *Meetings*, Free Library, First Friday in each month, 8 p.m. (Summer months excepted). *Ex.*, March. *Sec.*, Councillor Wm. Shakspeare, Avon House, Heanor Road, Ilkeston.

*Ipswich Camera Club.—*Pres.*, Dr. Francis Ward. *Meetings*, The Museum, Fourth Wednesday in each month, 8 p.m. *Ex.*, November. *Sec.*, R. H. Sutton, 37, Henley Road, Ipswich.

*Ipswich Scientific Society (Photographic Section).—*Pres.*, Pollard Wilkinson, B.A., B.Sc., F.R.A.S. *Meetings*, Ipswich Museum, First Wednesday in each month, 7.30 p.m. *Secs.*, Frank Woolnough and Raymond Bennett, Museum, Ipswich.

*Isle of Man Camera Club.—*Particulars not received.*

*Isle of Thanet Photographic Society.—*Pres.*, Rev. Leonard Z. White-Thomson, M.A. *Meetings*, St. George's Men's Club. Broad Street, Wednesday evening, 8.30 p.m. *Ex.*, November. *Sec.*, S. H. Page, 6, Queen Street, Ramsgate.

*Isle of Wight Photographic Society.—*Pres.*, Professor John Milne, F.R.S., F.G.S. *Meetings*, Club Room, 112, Pyle Street, Newport, Isle of Wight, First and Third Wednesday October to March, Third Wednesday April to September. *Ex.*, October. *Sec.*, J. Howard Burgess, 53, Pyle Street, Newport, I.W.

Jarrow Camera Club. *Particulars not received from Secretary.*

Jersey Photographic Society.—*Pres.*, Dr. A. C. Stamberg. *Meetings*, Beresford Café, Beresford Street, Jersey, Tuesday, 8 p.m. *Sec.*, Rodney Porter, 2, South Villas, Stopford Road, Jersey.

Keighley and District Photographic Association.—*Pres.*, Wm. Robertshaw. *Meetings*, Mechanics' Institute. *Sec.*, Norman H. Barrett, Woodside, Keighley.

"Kennaway" Photographic Society.—*Pres.*, Rev. Prebendary H. E. Fox, M.A. *Meetings*, 16, Salisbury Square, London, E.C. *Ex.*, December. *Sec.*, Wm. R. C. Cooke, 16, Salisbury Square, London, E.C.

Keswick Photographic Society.—*Pres.*, F. P. Heath. *Meetings*, Keswick Library Class Room, Second and Fourth Fridays, 8 p.m., March to April. *Sec.*, H. A. Beadle, 10, Station Street, Keswick.

Kettering Camera Club.—*Pres.*, J. A. Gotch. *Meetings*, Kettering Church Institute, Second Thursday in month, 8 p.m. *Sec.*, E. Claypole, 112, Hawthorn Road, Kettering.

King's Lynn Photographic Society.—*Pres.*, S. A. Gurney. *Sec.*, W. E. Daw, Hunstanton.

***Kingston-on-Thames and District Photographic Society.**—*Pres.*, Rev. G. I. Swinnerton, M.A. *Meetings*, Kingston Public Library, Mondays, October to March, 8.15 p.m. *Secs.*, John F. East, Uxbridge House, Kingston-on-Thames, and A. W. Grant, Woodleigh, Cranes Park Avenue, Surbiton.

Kinning Park Co-operative Society Govan Camera Club.—*Pres.*, George Peebles. *Meetings*, 6, James' Place, Govan, every alternate Monday, 8 p.m. *Sec.*, Jas Maclagan, Jun., 16, Drive road, Govan.

Kirkcaldy Photographic Society.—*Pres.*, Alex. Purves. *Meetings*, Society's Rooms, 196, High Street, Third Monday in each month, October to April, 8 p.m. *Sec.*, S. Stewart, 2, Salisbury Street, Kirkcaldy.

Lancaster Photographic Society.—*Pres.*, A. S. Barling. *Meetings*, Society's Rooms, Stonewell, Lancaster, Monday and Friday, 8 p.m. *Ex*, November. *Sec.*, R. T. Simpson, 60, North Road, Lancaster.

Larkhall Camera Club.—*Pres.*, Gavin Hamilton. *Meetings*, Camera Club Rooms, Milheugh Brae, Thursday, 8 p.m. *Ex.*, March. *Sec.*, Robert Rodger, 32, Drygate Street, Larkhall.

***Leeds Camera Club.**—*Pres.*, Charles B. Howdill, A.R.I.B.A. *Meetings*, The Old Bank, Commercial Street, Leeds, Wednesdays, 8 p.m. *Ex.*, Northern Photographic Exhibition in 1908. *Sec.*, F. G. Issott, 62, Compton Road, Harehills, Leeds.

Leeds Institute of Science and Art (Photographic Section).—*Chairman*, George Ward, F.C.S. *Meetings*, Cookridge Street, Thursday evenings. *Lecturer*, S. E. Bottomley. *Sec.*, Arthur Tait, Leeds Institute Technical School, Leeds.

Leeds Photographic Society.—*Pres.*, T. W. Thornton. *Meetings*, The Law Institute, Albion Place, Leeds, alternate Tuesdays, 8 p.m. *Ex.*, February 23, 1906. *Sec.*, A. Edwards, 12, Norwood Terrace, Hyde Park, Leeds.

Leek and District Photographic Society.—*Pres.*, G. V. Myatt. *Meetings*, Bank Chambers, Derby Street, Leek, Monday and Thursday evenings. *Ex.*, April. *Sec.*, Chas. Brassington, 52, Grove Street, Leek, Staffs.

***Leicester and Leicestershire Photographic Society.**—*Pres.*, Walter B. Woodland. *Meetings*, Oriental Cafe, Market Place, Second and Fourth Wednesdays, 8 p.m. *Ex.*, March. *Sec.*, William Murray, 60, Melton Road, Leicester.

***Leicester Literary and Philosophical Society** (Photographic Section).—Chairman, G. B. Dixon. F.E.S. *Meetings*, Council Room, Town Museum, Second Friday October to April, 8 p.m. *Ex.*, April 10, 1906. *Sec.*, G. Owston Marshall, Carisbrooke," Victoria Road.

Leigh Photographic Society, Lancs.—*Pres.*, Dr. H. S. Hall. *Meetings*, Social Hall, Railway Road, Leigh, alternate Thursdays, 8 p.m. *Ex.*, November and December. *Sec.*, H. W. Coupe, 69, The Avenue, Leigh.

Leith Amateur Photographic Association.—*Pres.*, Thos. Wilson. *Meetings*, 36, Charlotte Street, Leith, last Tuesday September to April. *Ex.*, November and February. *Sec.*, Wm. McK. Dalziel, 102, Constitution Street, Leith, N.B.

Lewes Photographic Society.—*Pres.*, Ald. G. J. Wightman. *Meetings*, Lewes Town Hall, First Tuesday in the month, 8 p.m. *Sec.*, Geo. Carpenter, 81, High Street, Lewes.

***Liverpool Amateur Photographic Association.**—*Pres.*, Dr. C. Thurstan Holland. *Meetings*, Percy Buildings, 9, Eberle Street, Liverpool, Thursday evenings, 7.30 p.m., from September 28 to April 30. *Ex.*, January. *Sec.*, A. C. Batty, 9, Eberle Street, Liverpool

Liverpool Central Y.M.C.A. Camera Club.—*Pres.*, Richard Brown. *Meetings*, Y.M.C.A., Mount Pleasant, Liverpool, last Thursday in each month, October to March, 8 p.m. *Sec.*, John Graham, 29, Alfred Road, Birkenhead.

Liverpool (East) Photographic Society.—*Particulars not received from Secretary.*

Liverpool Municipal Technical Students' Association.—*Pres.*, T. H. Pritchard. *Meetings*, Central Technical Schools, Liverpool, Saturdays, Fortnightly, 7.30 p.m. *Sec.*, John F. Haws, Central Technical Schools.

Liverpool University Chemical Society.—*Particulars not received from Secretary.*

*__London and Provincial Photographic Association.__—*Trustees*, T. E. Freshwater and A. Haddon. *Meetings*, White Swan, Tudor Street, London, E.C., every Thursday, 8 p.m. *Sec.*, Herbert C. Rapson, 13, Shaftesbury Road, Hornsey Rise, N.

*__London County Council Staff Camera Club.__—*Pres.*, C. E. Howse. *Meetings*, County Hall, Spring Gardens, and Education Offices, Victoria Embankment, alternately, last Tuesday in each month, 5.15 p.m. *Secs.*, Philip S. White, County Hall, Spring Gardens, S.W., and A. Rose, Education Offices, Victoria Embankment.

Londonderry Camera Club.—*Pres.*, Sir R. Newman Chambers, Knt. *Meetings*, R. A. Austin's, Chemist, 12, Strand Road. *Sec.*, R. W. Saville, 7, Academy Terrace.

Longsight and Levenshulme Camera Club.—*Pres.*, Mr. S. S. Lees. *Meetings*, Midway Hotel, Stockport Road, Levenshulme, Fortnightly, Wednesday, 8.30 p.m. *Sec.*, H. J. Johnson, 22, Sullivan Street, Longsight, Manchester.

*__Longton and District Photographic Society.__—*Pres.*, Dr. A., Parkes, J.P. *Meetings*, Sutherland Institute, Stone Road, Thursday, 7.30 p.m. *Sec.*, Thos. Mottershead, 43, Stafford Street, Longton, Staff.

Louth and District Photographic Society.—*Pres. and Sec.*, Rev. J. Edward Standen, M.A.

*__Luton Camera Club.__—*Pres.*, Dr. F. Seymour Lloyd. *Meetings* Y.M.C.A. Rooms, Chapel Street, Luton, Mondays, September to January, 8 p.m. *Ex.*, December. *Sec.*, William H. Cox, 90, Castle Street, Luton.

*__Lyonsdown Amateur Photographic Association.__—*Pres.*, A. Bentley. *Meetings*, Members houses, Second Wednesday in each month, 8 p.m. *Sec.*, C. A. S. Koch, Ellington, Hadley Road, New Barnet.

*__Manchester Amateur Photographic Society.__—*Pres.*, S. L. Coulthurst. *Meetings*, Manchester Athenæum, Second Tuesday in each month, except August, Society's Rooms and Library, Ducie Chambers, 57, Market Street. *Ex.*, October. *Sec.*, F. W. Parrott, 11, Elm Road, Altrincham.

__Manchester Camera Club.__—*Meetings*, Victoria Hotel, Manchester. *Sec.*, Chas. Dawson, 34, Queen Street, Manchester.

__Manchester Photographic Society.__—*Pres.*, W. E. Wood. *Meetings*, Second Monday in each month, 7.30 p.m. *Sec.*, C. H. Coote, 10, Holmefield, Sale, Manchester.

__Manchester Y.M.C.A. Photographic Club.__—*Pres.*, J. W. Price. *Meetings*, Y.M.C.A., 56, Peter Street, Manchester, monthly. *Ex.*, December. *Sec.*, H. C. Dumler, 56, Peter Street, Manchester.

__Marple and District Photographic Society.__—*Defunct.*

__Marple Wesleyan Photographic Society.__—*Pres.*, J. A. Hulme. *Meetings*, Wesleyan School, Marple, First and Third Saturdays, 7.30 p.m. *Sec.*, F. Warren, Stockport Road, Marple.

__Mid-Cheshire Society of Arts__ (Photographic Section).—*Sec.*, Geo. Holland, 17, Stanley Mount, Barnton, Northwich.

__Midlothian Camera Club.__—*Pres.*, Thomas Wilson. *Meetings*, 61, Leith Walk, Leith. *Sec.*, Geo. Cleland, Bank of Scotland, 61, Leith Walk, Leith.

__Millfields Road (Clapton) E.C. School Photographic Society.__ *Pres.*, J. Cox. *Meetings*, Millfields Road School, Clapton. N.E., Monthly by arrangement. *Ex.*, December. *Sec.*, Charles W. Muller, 62, Waterloo Road, Leyton.

__Morley and District Photographic Society.__—*Pres.*, Dr. S. T. Steele. *Meetings*, Queen Street, Tuesday, 8 p.m. *Sec.*, Ernest B. Bradley, Worrall Street, Morley, Yorks.

__Motherwell Y.M.I. Camera Club.__—*Pres.*, R. Kilpatrick. *Meetings*, Young Men's Institute, Motherwell. *Ex.*, February, 1906. *Secs.*, D. Martin and W. Millar, 7, Macdonald Street, Motherwell.

__Muirkirk Amateur Photographic Association.__—*Pres.*, Rev. Jas. Greenshields, B.D. *Meetings*, Baird Institute, every Fourth Tuesday in each month. 8 p.m. *Sec.*, Wm. Barrowman, Kennethmont, Muirkirk.

Nelson Photographic Society.—*Pres.*, A. E. Normington, M.B., Ch.B. *Meetings*, Victoria Hall, Scotland Road, Nelson, Tuesday, 7.30. *Sec.*, Thomas Hudson, 6, Rigby Street, Nelson.

***Newark Photographic Society.**—*Pres.*, J. Brown. *Meetings*, Mechanics' Institute, Newark-on-Trent, Wednesday, Fortnightly, from October to April, 8.30 p.m. *Sec.*, J. M. Burns, 71, Harcourt Street, Newark-on-Trent.

Newbury Guildhall Camera Club.—*Pres.*, Miss G. Bacon. *Meetings*, Club Room. *Sec.*, T. C. Beynon, "Cheriton," Newbury.

***Newcastle-on-Tyne and Northern Counties' Photographic Association.**—*Pres.*, J. W. Dyson. *Meetings*, Crosby's Café, 51, Northumberland Street, Newcastle-on-Tyne, First and Third Tuesday in month, 7.30 p.m. *Sec.*, F. Milburn, 75, Rothwell Road, Gosforth, Newcastle-on-Tyne.

Newton Heath Camera Club.—*Pres.*, G. A. Wilson. *Meetings*, Newton Heath Wesleyan School, Third Friday in each month. *Sec.*, J. Taylor, 103, Lightbourne Road, Moston, Manchester.

***Northampton Natural History and Field Club** (Photographic Section).—*Pres.*, H. Manfield, J.P. *Meetings*, British Empire Buildings, Sheep Street, Northampton. *Sec.*, C. H. Dorman, A.R.I.B.A., 53, Abington Street, Northampton.

Northcote Camera Club.—*Pres.*, Rev. E. B. Clarabut and Ernest P. Dix. *Meetings*, St. Michael's Schools, Walthamstow, Second Monday in each month, 8 p.m. *Ex.*, October. *Sec.*, H. Clifford Bennett, 26, Granville Road, Walthamstow.

Northern Camera Club.—*Particulars not received from Secretary.*

***North Middlesex Photographic Society.**—*Pres.*, Charles Beadle. *Meetings*, Hanley Hall, Sparsholt Road, Crouch Hill, Wednesday, 8 p.m. *Ex.*, December. *Sec.*, S. C. Puddy, 87, Crouch Hill, N.

***North-West London Photographic Society.**—*Pres.*, Edwin Styles. *Meetings*, Y.M.C.A. Buildings, 17, Camden Road, N.W., Second and Fourth Thursdays in month, June, July, and August excepted. *Ex.*, February. *Sec.*, Henry S. Date, 3a, Woodsome Road, Highgate Road, N.W.

Norwich and District Photographic Society.—*Pres.*, A. E. Coe. *Meetings*, Strangers' Hall, Norwich, First Monday in every month, 8 p.m. *Ex.*, February. *Sec.*, J. T. Tanner, The Lodge, Bowthorpe Road, Norwich.

***Nottingham Camera Club** (Mechanics' Institution). —*Pres.*, Arthur Marshall, A.R.I.B.A. *Meetings*, Nottingham Mechanics' Institution, Fortnightly, 8 p.m. *Ex.*, March 14 to 17, 1906. *Sec.*, S W. Barlow-Vines, Market Chambers, South Parade, Nottingham.

Oldham Equitable Photographic Society.—*Pres.*, William Mann. *Meetings*, Equitable Co-operative Society's Rooms, Mondays, 7.30 p.m. *Sec.*, Chas. Ledger, 6, Airey Street, Oldham.

Oldham Field Naturalists' and Photographic Society.—Now Equitable Photographic Society, Oldham.

Oldham Photographic Society.—*Pres.*, G. H. Wright. *Meetings*, Trust Buildings, Manchester Street, Oldham, Thursday evening, 8 p.m. *Ex.*, March. *Sec.*, Wm. Taylor, 176, Coppice Street, Oldham.

Otley and District Camera and Art Society.—*Pres.*, A. Marshall, M.S.A. *Meetings*, The Photographic Institute, Wesley Street, Otley, Tuesday, 7.30 p.m. *Sec.*, Fred. T. Taylor, Bridge Street, Otley, Yorks.

Outer Hebrides Photographic Society.—*Pres.*, Archd. A. Chisholm. *Meetings*, Lochmaddy. *Ex.*, September. *Sec.*, Archd. A. Chisholm, Lochmaddy, Scotland.

***Oxford Camera Club.**—*Pres.*, Sir W. J. Herschel, Bart. *Meetings*, The University Museum, Second and Fourth Mondays. *Ex.*, November. *Sec.*, Geo. W. Norton, 149, Woodstock Road.

Paisley Philosophical Institution (Photographic Section).—*Pres.*, John S. Bryce. *Meetings*, 28, Oakshaw Street, Thursday, 8 p.m. *Ex.*, March. *Sec.*, Robert Milne, Linndale, Potterhill, Paisley.

Perthshire Society of Natural Science (Photographic Section). —*Pres.*, Henry Coates. *Meetings*, Natural Science Hall, Perth, *Sec.*, A. Mackenzie, 42, Scott Street, Perth.

***Peterborough Photographic Society.**—*Pres.*, Geo. Kirkwood M.D. *Meetings*, Bedford Temperance Hotel, Thursdays, 8.15 p.m. *Sec.*, T. J. Calcutt, 46, Narrow Street, Peterborough.

***Photographic Club.**—*Trustees*, F. A. Bridge and H. Snowden Ward, F.R.P.S. *Meetings*, Red Cross Hotel, Paternoster Square, E.C. Wednesdays, 8 p.m. *Sec.*, T. W. Derrington, 1, Clarence Road, Wimbledon, S.W.

***Photographic Society of Ireland.**—*Pres.*, J. Alfred Scott, M.D., F.R.C.S.I. *Vice-Pres.*, Robert Benson and Hugh Pollock, B.L. *Meetings*, Leinster Lecture Hall, 35, Molesworth Street, Dublin, Second and Fourth Friday in each month, October to April. *Ex.*, March. *Sec.*, H. V. Yeo, B.L., 194, Clonliffe Road, Drumcondra, Dublin. *Assist. Sec.*, W. F. Cooper.

***Plymouth Photographic Society.**—*Pres.*, J. T. Johnson. *Meetings*, The Athenæum, George Street, Plymouth, alternate Fridays, 8 p.m. *Sec.*, Alfred W. Hicks, 8, Chester Place, Mutley, Plymouth.

Plympton Photographic Society.—*Pres.*, Dr. Aldridge. *Sec.*, T. H. Wilks, Plympton House, Plympton, South Devon.

***Polytechnic Photographic Society.**—*Pres.*, Howard Farmer. *Meetings*, 309, Regent Street, W., Thursday, 8.15 p.m. *Ex.*, January. *Sec.*, Charles E. Crake, 2a, Niederwald Road, Sydenham, S.E.

***Preston Scientific Society** (Photographic Section).—*Chairman*, W. Phillips. *Meetings*, 119a, Fishergate, Tuesday, 8 p.m. *Ex.*, February. *Sec.*, A. W. Cooper. 31, Kenmure Place, Garstang Road, Preston.

Pudsey and District Photographic Society.—*Pres.*, M. V. Wilson. *Meetings*, Mechanics' Institute, Pudsey, Thursdays, 8 p.m. *Sec.*, W. Green, Bankfield Terrace, Fartown, Pudsey.

***Reading and District Photographic Society.** — *Pres.*, Alf. Palmer, J.P. *Meetings*, Abbey Gateway, The Forbury, Tuesdays, 8 p.m. *Ex.*, November. *Sec.*, George Green, 77, Donnington Gardens, Reading.

Redcar and Coatham Literary Institute Photographic Society.—*Pres.*, J. E. Stead, F.R.S. *Meetings*, The Literary Institute, Redcar, Yorks. *Secs.*, P. H. Hutchinson, "Okeford," Coatham, Redcar, and C. E. Cowper, "The Studio," Coatham, Redcar.

Redhill and District Camera Club.—*Pres.*, Frederick Hollyer. *Meetings*, Market Hall, Redhill, Tuesdays, fortnightly, 8 p.m. *Ex.*, November. *Sec.*, James Paterson, M.A., "Whalley," Lynwood Road, Redhill.

***Richmond Camera Club.**—*Pres.*, F. P. Cembrano. *Meetings*, Freemasons' Club, Sheen Road, Richmond, Thursdays, 8 p.m., October to April. *Sec.*, J. A. Abbott, St. Leonard's House, East Sheen, S.W.

Ripon Portfolio Club.—*Sec.*, Henry Bulmer Rudd, 29, Westgate, Ripon, Yorkshire.

Rishton and District Camera Club.—*Particulars not received from Secretary.*

Rodley, Farsley and Calverley District Photographic Society.—*Pres.*, Wm. Whittaker. *Meetings*, alternately at Rodley, Farsley and Calverley, Fortnightly in Winter, Thursdays, 8 p.m., and in Summer, Monthly. *Sec.*,* H. Crossley, Rodley, near Leeds.

***Rotherham Photographic Society.**—*Pres.*, E. Isle Hubbard, M.S.A. *Meetings*, 5, Frederick Street, or Town Hall Assembly Room, First Tuesday in each month, 8 p.m. *Ex.*, October. *Sec.*, H. C. Hemingway, Tooker Road, Rotherham.

Rover Camera Club.—*Particulars not received from Secretary.*

Royal Cornwall Polytechnic Society.—*Pres.*, The Lord Bishop of Ripon. *Meetings*, Polytechnic Hall, Falmouth. *Ex.*, August or September, 1906. *Sec.*, Edward Kitto, The Observatory, Falmouth.

***Rugby Photographic Society.**—*Pres.*, B. B. Dickinson, M.A., *Meetings*, Physical Lecture Room of Rugby School, Second and Fourth Thursdays, October to April. *Ex.*, March. *Sec.*, R. H. Myers, 13, Bridget Street, Rugby.

Sale Photographic Society.—*Pres.*, W. Asquith. *Meetings*, Sale Public Hall, Wednesday, 8 p.m. *Sec.*, J. Pilkington, 137, Marsland Road, Brooklands.

***St. Albans Photographic Society.**—*Pres.*, W. J. Armitage. *Meetings*, The Chemical Laboratories of St. Albans School, alternate Fridays, 8.30 p.m. *Ex.*, March. *Sec.*, Charles H. Ashdown, F.R.G.S., F.C.S., &c., Monastery Close, St. Albans.

St George Co-operative Society Camera Club.—*Pres.*, William Park. *Meetings*, 40, Gladstone Street, every alternate Friday from October 27th. *Sec.*, J. B. Tulloch, 37, Gladstone Street, Glasgow.

St. Helens Camera Club.—*Pres.*, L. Williams. *Meetings*, 32, Church Street, Tuesdays, 8 p.m. *Ex.*, March. *Sec.*, John Glover, 14, Ormskirk Street, St. Helens.

St Michael's Photographic Society.—*Pres.*, Rev. A. F. Thornhill, M.A. *Meetings*, Club Rooms, 45, St. Michael's Road. *Ex.*, January. *Sec.*, Herbert Winstanley, 14, St. Michael's Road, Liverpool.

Salford Amateur Photographic Society.—*Particulars not received from Secretary.*

Scarborough and District Photographic Society.—*Pres.*, E. L. Davis. *Meetings*, The Museum, Monday, 8 p.m. *Ex.*, December. *Sec.*, Frank Foster, 16, Victoria Road, Scarborough.

Sefton Park, Liverpool, Photographic Society. — *Pres.*, Rev. C. C. Elcum, M.A. *Meetings*, St. Barnabas' Hall, Smithdown Road, Second and Fourth Wednesdays, 8 p.m. *Ex.*, November. *Sec.*, H. Cubley, 3, Langdale Road, Sefton Park.

Shaw Church Institute Photographic and Art Society.—*Pres*, R. H. Harnwell. *Meetings*, Second Tuesday in each month, 8 p.m. *Sec.*, John Maiden, 93, Rochdale Road, Shaw, near Oldham.

Sheffield and Hallamshire Photographic Society.—*Pres.*, Frank Mottershaw. *Meetings*, Baptist Schools, Cemetery Road, Sheffield, Second Wednesday in each month, 8 p.m. *Ex.*, November. *Sec.*, Fred Lowe, 41, Carrington Road, Sheffield.

Sheffield Friends' Schools Photographic Society. — *Pres.*, Robert Wilson. *Meetings*, Friends' School, Hartshead, Third Thursday in each month, 8 p.m. *Ex.*, February 18, 1906. *Sec.*, John Varley, 107, Ripon Street, Attercliffe, Sheffield.

***Sheffield Photographic Society.**—*Pres.*, G. E. E. Noble. *Meetings*, The Builders' Exchange, Cross Burgess Street, First Tuesday in the month. *Ex.*, November. *Sec.*, James W. Wright, 62, Vale Road, Sheffield.

Shettleston Camera Club.—*Pres.*, W. G. Aird. *Meetings*, Eastmuir School, Main Street, First and Third Monday. *Ex.*, January. *Sec.*, Wm. Kitson, Hawthorn Villa, Shettleston.

Shipley and District Photographic Society.—*Particulars not received from Secretary.*

Shotts Camera Club.—*Pres.*, A. W. Hoill. *Meetings*, Shotts Public Hall. *Sec.*, James Twaddle, Burnside House, Shotts.

***Shropshire Camera Club.**—*Pres.*, H. W. Hughes. *Meetings*, Castle Chambers, Shrewsbury, day variable; time, 8 p.m. *Sec.*, J. W. Heath, 18, Pride Hill, Shrewsbury.

Simpson Memorial Institute Camera Club.—*Pres.*, Dr. A. T. Lakin. *Meetings*, Simpson Memorial Institute, Moston, Manchester, alternate Fridays, 8.15 p.m. *Ec.*, October. *Sec.*, W. A. Tyas, Jun., Oak Bank, Blackley, Manchester.

Skipton Photographic Society.—*Pres.*, A. H. Dawes. *Meetings*, Science and Art Schools, Skipton, monthly (irregular), 8 p.m. *Sec.*, F. E. Dodson, Town Hall, Skipton.

***Slough Photographic Society.** — *Pres.*, Ernest Oetzmann. *Meetings*, Leopold Institute, Slough, Monday evenings, October to March, 8.30. *Sec.*, George Young, Hencroft Street, Slough.

Small Heath Photographic Society. — *Pres.*, Geo. F. Bull. *Meetings*, Council Schools, Somerville Road, Small Heath, Thursdays, 8.30 p.m. *Sec.*, Alfred Roffey, 586, Coventry Road, Birmingham.

***Southampton Camera Club.**—*Pres.*, W. Burrough Hill, F.S.I. *Meetings*, Philharmonic Hall, Mondays, 8 p.m. *Ex.*, November or December. *Sec.*, S. G. Kimber, Oakdene, Highfield, Southampton. (The Photographic Convention meets here in July, 1906.)

South Devon Teachers' Camera Club.—*Pres.*, A. W. Searley. *Meetings*, no fixed place; meet at various towns, Third Saturday in every month, 2.30 p.m. *Sec.*, Chas. Mole, Broadhempston, Totnes.

***Southend-on-Sea Photographic Society.** — *Pres.*, Councillor A. C. Loury. *Meetings*, Technical School, Thursday, 8 p.m. *Sec.*, John Archer, 24, Ashburnham Road, Southend.

***South Essex Camera Club.**—*Pres.*, Walter D. Welford, F.R.P.S. *Meetings*, Wakefield Hall, Wakefield Street, East Ham, Wednesday, 8 p.m., Second and Fourth in Winter, Second in Summer. *Ex.*, January 1906. *Sec.*, Thomas Michell, 180, Browning Road, Manor Park, E.

Southland Camera Club.—*Pres.*, James Stewart. *Meetings*, Esk Stree, Invercargill. *Sec.*, R. A. Edwards, Dee Street, Invercargill.

***South London Photographic Society.**—*Pres.*, J. T. French. *Meetings*, Collyer Hall Schools, High Street, Peckham, S.E., First and Third Mondays to September, every Monday October to February, 8 p.m. *Ex.*, March 3 to 10, 1906. *Sec.*, H. Creighton Beckett, 44, Edith Road, Peckham, S.E.

South Norwood Photographic Society.—*Pres.*, John Smith. *Meetings*, Bank Chambers, 251, Selhurst Road, South Norwood, Thursdays, 8 p.m. *Ex.*, November. *Sec.*, George R. Beckett, 28, Carmichael Road, South Norwood.

***Southport Photographic Society.**—*Pres.*, Willis Brunt. *Meetings*, Queen's Hall, Nevill Street, First and Third Thursday, October to April, inclusive, 7.45 p.m. *Sec.*, John T. Rigby, 1, Hoghton Street, Southport.

***Southsea Photographic Society.**—*Pres.*, H. T. Lilley, M.A. *Meetings*, 5, Pembroke Road, Portsmouth, Wednesday, 8.30 p.m. *Ex.*, December. *Sec.*, F. J. Lawton, 20, Clarence Square, Gosport.

South Shields Photographic Society.—*Pres.*, A. J. Hunter, F.R.H.S. *Meetings*, Y.M.C.A. Rooms, Charlotte Terrace, First and Third Tuesdays of the month, 8.30 p.m. *Ex.*, March. *Sec.*, T. H. Clulee, 1, Eastbourne Grove, South Shields.

Stafford Photographic Society.—*Pres.*, A. J. Dean. *Meetings*, Old Police Barracks, Stafford, First Tuesday and Third Monday in each month, 8 p.m. *Sec.*, Herbert A. E. Hey, Tillington, Stafford.

Stirling Photographic Society.—*Pres.*, James Johnston. *Meetings*, Corn Exchange Rooms, Wednesday, 8 p.m. *Ex.*, April. *Sec.*, John Walker, 67, King Street, Stirling.

Stockport Photographic Society.—*Pres.*, Dr. Brennan. *Meetings*, Mechanic's Institute, Second and Fourth Wednesdays in month. *Ex.*, December. *Sec.*, Ernest Chadwick, Springmont House, Brinksway, Stockport.

Stoke Newington Princess May Camera Club.—*Pres.*, A. J. Prestage. *Meetings*, Princess May School, Stoke Newington, every Wednesday and Friday. *Sec.*, G. Pratt, 49, Victoria Road, Stoke Newington, N.

***Stratford—G. E. R. Mechanics' Institution** (Photographic Section).—*Pres.*, J. Holden, M.I.C.E., M.I.M.E. *Meetings*, G.E.R. Mechanics' Institution, Store Street, Stratford, E., Wednesdays, October to April, 8 p.m. *Ex.*, March 13 and 14, 1906. *Sec.*, A. Woolford, 16, Grove Green Road, Leytonstone, E.

Sunderland Camera Club.—*Pres.*, Wm. Thackeray. *Meetings*, 298, High Street West, Sunderland, Tuesday, 7.30 p.m. *Ex.*, November. *Sec.*, Oscar Möller, 1, Thornhill Gardens, Sunderland.

***Sunderland Photographic Association.**—*Pres.*, William Milburn. *Meetings*, Subscription Library, alternate Thursdays, 7.30 p.m. *Ex.*, March 19 to 24, 1906. *Sec.*, William E. Kieffer, Stirling Street, Sunderland.

***Sutton Photographic Club.**—*Pres.*, Hector Maclean. *Meetings*, Public Hall Chambers, Sutton, Wednesday, 8.15 p.m. *Sec.*, C. Thwaites, M.Inst.C.E., F.R.A.S., Meaburn, Burnell Road, Sutton, Surrey.

***Swansea Camera Club.**—*Pres.*, D. Davies. *Meetings*, 14 and 15, Temple Street, Mondays. *Ex.*, January or February. *Sec.*, W. R. Stephens, 14 and 15, Temple Street, Swansea.

Tamworth and District Photographic Society.—*Pres.*, Rev. Wm. MacGregor, M.A., J.P. *Meetings*, 15, Market Street, Tamworth, Tuesday, 8 p.m. *Ex.*, December. *Sec.*, John W. Parker, 17, Heath Street, Tamworth.

***Taunton Photographic Society.**—*Particulars not received from Secretary.*

***Thornton Heath Photographic Society.**—*Pres.*, Walter Wood. *Meetings*, 86, High Street, Thornton Heath, Tuesday, 8 p.m. *Ex.*, April. *Sec.*, J. H. Robertson, "Elton," Norfolk Road, Thornton Heath.

Torbay Camera Society.—*Pres.*, Col. W. Fothergill Macmullen. *Meetings*, First Wednesday in each month. *Sec.*, Chas. R. Rowe, M.J.I., Dudley Lodge, Saltash.

Tring Camera Club.—*Pres.*, The Hon. N. Charles Rothschild. *Meetings*, Constitutional Club. Tring, Wednesday, 7.15 p.m. *Ex.*, January 31, 1906. *Sec.*, J. Owen Raymond, Frogmore Street, Tring.

***Tunbridge Wells Amateur Photographic Association.**—*Pres.*, F. G. Smart, J.P.. M.A., F.R.Met.S., F.L.S., etc. *Meetings*, Club Room, Mechanics' Institute, First Thursday and Third Wednesday, 8.15 p.m. *Ex.*, January. *Sec.*, Joseph Chamberlain, Tankerville, Cambridge Street.

Tynemouth Photographic Society.—*Pres.*. W. S. Gorder, J.P. *Meetings*, Presbyterian Hall, North Shields, alternate Thursdays, 8 p.m. *Ex.*, November 29th and 30th. *Sec.*, John B. Scott, 1, Bedford Terrace, North Shields.

Tyneside Camera Club.—*Pres.*, A. B. Gardiner. *Meetings*, 9, St. Mary's Cottages, Rye Hill, Newcastle-on-Tyne. *Sec.*, Joseph Fraser M'Kie, 9, St. Mary's Cottages, Rye Hill, Newcastle-on-Tyne.

Tyneside Geographical Camera Club.—*Pres.*, His Grace the Duke of Northumberland. *Meetings*, News Room, Geographical Institute, First Thursday in each month. *Ex.*, March. *Sec.*, John Scott, 10, Mosley Street, Newcastle-upon-Tyne.

Ulster Amateur Photographic Society.—*Pres.*, David Elliott, B.A., T.C.D. *Meetings*, The Museum, College Square North, Belfast, Second Mondays, October till April (inclusive), 8 p.m. *Sec.*, Thomas Nolan Murray, The Museum, College Square North, Belfast.

Uxbridge and District Camera Club.—*Particulars not received from Secretary.*

Wallasey Amateur Photographic Society.—*Pres.*, Rev. A. Ernest Parry. *Meetings*, 110, Brighton Street, Seacombe, alternate Mondays, 8 15 p.m. *Sec.*, Wm. Hayes, 110, Brighton Street, Seacombe.

**Wallington Camera Club.*—*Pres.*, Lieut.-Col. Gale, V.D., F.R.P.S. *Meetings*, Sterndale Rooms, Wallington Fourth Tuesday each month, 8 p.m. *Sec.*, John A. Lash, London and South-Western Bank, Wallington.

Walsall Amateur Photographic Society.—*Pres.*, A. Ford. *Meetings*, Assembly Rooms, The Square, Walsall, Fridays, 8 p.m. *Sec.*, W. T. Comer, D.B.O.A., F.S.M.C., 6, Arcade, Walsall.

***Walthamstow Photographic Society.**—*Pres.*, W. A. Longmore, F.R.I.B.A. *Meetings*, The Hall, Vestry Road, Walthamstow, Essex, First and Third Mondays in each month, 8 p.m. *Ex.*, November. *Sec.*, Thomas R. Nunn, 29, The Drive, Walthamstow.

***Wandsworth Camera Club.**—*Pres*, Charles Moss. *Meetings*, 106, High Street, Wandsworth, S.W., First and Third Mondays, 8.15 p.m. *Ex.*, February 19, 1906. *Sec.*, E. D. Perrin, 107, Melody Road, Wandsworth, S.W.

***Warrington Photographic Society.**—*Pres.*, F. V. L. Mathias, A.M.I.E.E. *Meetings*, Old Academy, Bridge Street, Tuesday, 7.45 p.m. *Ex.*, May. *Sec.*, A. C. Smithson, 13, Chester Road, Warrington.

Walton (Liverpool) Photographic Society.—*Pres.*, F. Murphy. *Meetings*, Walton Church (Old) Schools. Second Wednesday in each month, 8 p.m. *Sec.*, T. Bickerstaffe, 79, Rawcliffe Road, Walton, Liverpool.

***Watford Camera Club.**—*Pres.*, The Lord Hyde. *Meetings*, 100, High Street, Watford, every Thursday, 8.30 p.m. *Ex.*, December. *Sec.*, Edwin H. Jackson, 100, High Street, Watford

***Watford Photographic Society.**—*Chairman*, C. R. Girardot. *Meetings*, Watford Public Library, alternate Fridays, 8 p.m. *Sec.*, C. J. Trevarthen, Ashcroft, Bushey Hall Road, Watford.

*Wearside Camera Club.—*Pres.*, Wm. Percy Mail. *Meetings*, 297, High Street, West Sunderland, every Thursday evening. *Ex.*, November. *Sec.*, Bert Jackson, Burn Park House, Sunderland.

*"Wellcome" Photographic Club.—*Pres.*, H. S. Wellcome. *Meetings*, Wellcome Club and Institute, Dartford, Kent, Thursday in every second month, 8 p.m. *Ex.*, December. *Sec.*, F. Stadley Clarke, Wellcome Club and Institute, Dartford, Kent.

Wesley Camera Club, Accrington.—*Pres.*, G. Blackledge. *Meetings*, Wesley School, Accrington. *Sec.*, R. Kenyon, 8, Beaconsfield Street, Accrington.

*West Bromwich Photographic Society.—*Pres.*, Stephen J. Holliday. *Meetings*, Crowther's Rooms, West Bromwich, alternate Thursdays (October 5 onwards), 8 p.m. *Sec.*, J. B. Garner, Bratt Street, West Bromwich.

West Calder Camera Club.—*Pres.*, R. Wells Brown. *Meetings*, No. 4 Room adjoining People's Hall, Tuesdays, *Ex.*, September. *Sec.*, Lawrence Girdwood, 27, Hermand, West Calder.

*West Hartlepool Amateur Photographic Society.—*Particulars not received from Secretary.*

*West London Photographic Society.—*Pres.*, Geo. Lamley, F.R.P.S. *Meetings*, Wycombe Hall, 263, Hammersmith Road, W., alternate Fridays, 8 p.m. *Ex.*, February. *Sec.*, G. F. Perrins, 20, Rockley Road, West Kensington, W.

*West Surrey Photographic Society.—*Pres.*, Dr. H. Pelham Webb. *Meetings*, Lecture Hall, Railway Hotel, Battersea Rise, Wednesday, 9 p.m. *Ex.*, April. *Sec.*, Chas. A. Clear, 10, Grandison Road, Clapham Common, S.W.

*West Wight Camera Club, Freshwater, I.W.—*Meetings*, Rookwood, Totland Bay, I.W., First and Third Thursdays. *Sec.* Ernest A. Levane, Rookwood, Totland Bay, I.W.

*Weymouth Photographic Sooiety.—*Pres.*, C. E. E. Mercer. *Meetings*, Technical Schools, every Friday, 8.15 p.m. *Sec.*, F. C. Mace, 2, Clarence Buildings. *Assist.-Sec.*, J. C. Talbot, Exmouth House, Rodwell.

Whitby Camera Club.—*Pres.* G. S. French. *Meetings*, Cliff Street Board Schools. *Ex.* March. *Sec.*, Woodhouse Parkinson, Ocean Road, Whitby, Yorks.

Whitehaven Y.M.C.A. Camera Club.—*Pres.*, John Hayward. *Meetings*, Y.M.C.A. Rooms, Irish Street, Tuesday, 7.45 p.m. *Sec.*, J. A. Woodnorth, 21a, Duke Street, Whitehaven.

Willesden Polytechnic Photographic Society.—*Pres.*, W. B. Luke. *Meetings*, The Willesden Polytechnic, Priory Park Road, Kilburn, N.W., First and Third Mondays, 8 p.m. *Sec.*, Geoffrey E. Peachey, 2, Buxton Mansions, Willesden Green, N.W.

***Wimbledon and District Camera Club.**—*Pres.*, Peter Keary. *Meetings*, Johnstone's, 6, The Broadway, alternate Thursdays, 8 p.m. *Sec.*, J. Munro, 96, Richmond Road, Cottenham Park, S.W.

***Windsor Camera Club.**—*Pres.*, Sir Francis Tress Barry, Bart., M.P. *Meetings*, Royal Albert Institute, Wednesday evenings, 8.15. *Ex.*, February. *Sec.*, Thomas J. Cartland, Thames Side, Windsor.

Wishaw Photographic Association.—*Pres.*, Alexander Symon, M.A., B.Sc. *Ex.*, December and January. *Sec.*, Robt. Telfer, 138, Glasgow Road, Wishaw.

Wolverhampton Photographic Society.—*Pres.*, James Gale. *Meetings*, St. Peter's Institute, St. Peter's Square, Wolverhampton, First Monday and Third Wednesday, 8 p.m. *Ex.*, Second week in March. *Sec.*, Dr. Turton, 6, Bath Road, Wolverhampton.

***Wolverton Literary and Scientific Society** (Photographic Section).—*Pres.*, G. M. Fitzsimons, J.P. *Meetings*, Science and Art Institute, Wolverton, alternate Tuesdays, 7.30 p.m. *Sec.*, Charles Edgar Whitlock, 9, Buckingham Street, Wolverton.

***Woodford Photographic Society.**—*Pres.*, A. Liegele. *Meetings*, Wilfrid Lawson Hotel, First and Third Wednesday, 8.15 p.m. *Sec.*, F. G. Emler, Murton Villa, Chelmsford Road, Woodford, N.E.

***Woolwich Photographic Society.**—*Pres.*, C. Churchill, F.R.P.S. *Meetings*, St. John's Schools, Wellington Street, Woolwich, Second and Fourth Thursday in each month, 8 p.m., October and April inclusive. *Ex.*, March. *Sec.*, S. A. Saffron, 19, Winchester Street, Silvertown.

Worcester Camera Club.—*Defunct.*

Worcestershire Camera Club and Photographic Survey Society.—*Pres.*, Right Hon. Earl Beauchamp. *Meetings*, Club Rooms and Victoria Institute, Wednesdays. *Sec.*, Walter W. Harris, 101, High Street, Worcester.

Workington Photographic Society.—*Pres.*, W. L. Fletcher. *Meetings*, Carnegie Free Library, First and Third Tuesday in each month, October to April. *Ex.*, December. *Sec.*, John R. Taylor, 15, Station Road, Workington.

Worthing Camera Club.—*Pres.*, Colonel Arthur Henty, J.P. *Meetings*, 11, Liverpool Terrace, Worthing, Tuesdays, 8.15 p.m. *Ex.*, March, 1906. *Hon. Sec.*, Edmund F. H. Crouch, 11, South Street, Worthing.

Yeadon and District Photographic Society.—*Defunct.*

York Camera Club.—*Particulars not received from Secretary.*

York Photographic Society.—*Particulars not received from Secretary.*

***Yorkshire Philosophical Society** (Photographic Section).—*Pres.* Tempest Anderson, M.D., J.P. *Meetings*, The Museum, York, First Wednesday of each month October to May inclusive. *Secs.*, H. Dennis Taylor, Stancliffe, The Mount, York, and Malcolm Spence, Almerygarth, Marygate, York.

THE PROFESSIONAL PHOTOGRAPHERS' ASSOCIATION.

In Affiliation with the Chambre Syndicale de la Photographie et de ses Applications, of Paris.

HON. SECRETARY'S OFFICE: 51, Baker Street, London, W.

The Association was founded in March, 1901, for the purpose of promoting the interests of professional photography, the assistance of its members in their business dealings, and rendering them advice and assistance when in legal or other difficulties.

All professional photographers in business for themselves, or as managers of firms or companies, are entitled to membership.

The subscription is 5s. per annum.

Members' meetings are held on the second Fridays in October and January. The annual general meeting is held on the second Friday in March. The meetings are held at the Royal Photographic Society, 66, Russell Square, W.C.

The committee meets the second Friday in each month, except July, August, and September.

The Association grants certificates of competency to photographic operators, assistants, etc.

Members are entitled to transfer existing fire policies to a first-rate office at premiums 20 per cent. less than they are paying.

The Association publishes a handbook annually containing much valuable information concerning copyright and other laws which particularly affect photographers. The P. P. A. Circular, published quarterly, in addition to information concerning the work of the Association, also contains much useful information upon matters of interest and importance to professional photographers.

There are branches of the Association at Aberdeen, Edinburgh, Hull, and Liverpool.

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PAST PRESIDENT: Alfred Ellis (Ellis and Walery).

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HON. SOLICITOR: P. E. Marshall, 62, Lincoln's Inn Fields, London, W.C.

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PROFESSIONAL PHOTOGRAPHERS' SOCIETY OF NEW YORK.

PRESIDENT.—Pirie McDonald.

MEETINGS.—Murray Hill Hotel, New York.

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The objects of this Society are the betterment of the profession, and creating, fostering, and maintaining cordial relations between its members.

THE PHOTOGRAPHIC CONVENTION OF THE UNITED KINGDOM.

The Twenty-First Annual Meeting will be held at Southampton in July, 1906. Retiring President, Professor John Joly, F.R.S. The Photographic Convention was founded in 1886 for

the advancement of Photography, and to afford opportunities for personal intercourse and exchange of ideas amongst those interested in the art from all parts of the United Kingdom.

Meetings have been held at the following centres:—Derby, Glasgow, Birmingham, London, Chester, Bath, Edinburgh, Plymouth, Dublin, Shrewsbury, Leeds, Great Yarmouth, Glasgow (second visit), Gloucester, Newcastle-on-Tyne, Oxford, Cambridge, Perth, Derby (second visit), and Dublin (second visit).

Past Presidents.—J. Traill Taylor, Andrew Pringle, C. H. Bothamley, George Davison, William Bedford, George Mason, Sir Howard Grubb, A. Haddon, H. P. Robinson, F. P. Cembrano, John Stuart, William Crooke, Thos. Bedding, Sir William Herschel, Bart., Sir Robert Ball, Sir Robert Pullar, and G. Herbert Strutt.

Members of Council.—G. B. Bainbridge (Morpeth), Harold Baker (Birmingham), Godfrey Bingley (Leeds), George E. Brown (London), Henry Coates (Perth), W. J. Croall (Edinburgh), T. R. Dallmeyer (London), H. C. Draper, F.C.S. (Dublin), W. E. Dunmore (London), Alfred Ellis (London), H. Goodwillie (Dublin), T. K. Grant (London), Dr. E. Collier Green (Derby), E. J. Humphery (London), C. B. Keene (Derby), Sydney Keith (Hounslow), Furley Lewis (London), C. Phipps Lucas (London), J. W. Marchant (London), A. F. Mowll (Liverpool), G. W. Norton (Oxford), Rev. T. Perkins, M.A. (Blandford), Ralph Robinson (Redhill), J. A. C. Ruthven (Dublin), P. R. Salmon (London), F. H. Sanderson (Cambridge), J. A. Scott, M.D., F.R.C.S.I. (Dublin), T. Scotton (Derby), A. Seaman (Chesterfield), E. Webb Smith (Dublin), H. M. Smith (London), W. H. Smith (London). Henry Spink (Brighton), W. Taylor (Leicester), J. H. Walker (Leeds), E. J. Wall (London). H. Snowden Ward (London), Major-General J. Waterhouse, I.S.C. (London), S. B. Webber (London), J. B. B. Wellington (Elstree), and A. Werner (Dublin), Alex. M. Rodger (Perth), W. Crowther (Derby), R. Benson (Dublin), C. C. Cook (Southampton), A. E. Henley (Southampton), F. G. Ryder (Southampton), G. T. Vivian (Southampton), and T. M. Weaver (Southampton).

Trustees.—Frederick Albert Bridge, and Major-General Waterhouse.

Hon. Local Secretary: S. G. Kimber, Southampton.

Hon. General Secretary and Treasurer.—F. A. Bridge, East Lodge, Dalston Lane, London, N.E.

PHOTOGRAPHIC COPYRIGHT UNION.

PRESIDENT.—Frank Bishop.
VICE-PRESIDENT. — Alfred Ellis.
COMMITTEE.—W. E. Downey, C. M. Schomberg, Wm. Magrath, F. M. Sutcliffe, Warwick Brookes.
TREASURER.—Wm. Grove.
HON. SECRETARY.—J. Lillie Mitchell.
SECRETARY.—Henry Gower, 23, Soho Square, London, W.

The objects of this Union are to protect the interests of photographers in the publication of their work and to enforce the payment of fees for reproduction, etc. The members are expected to abide by its by-laws as to fees, etc., and in return they can obtain guidance or information respecting photographs wrongfully reproduced or copied. If litigation is necessary the Union, through its solicitor, will examine the facts and give expert advice free. If a lawsuit is undertaken and is unsuccessful, half the expenses are borne by the Union.

THE ARTISTIC COPYRIGHT SOCIETY.

PRESIDENT.—*Sir Lawrence Alma-Tadema, R.A.
ACTING VICE-PRESIDENT.—*Frank Dicksee, R.A.

GENERAL COMMITTEE.—*George W. Agnew (Chairman), Lockett Agnew, *Edwin Bale, R.I., Francis Bate, Sir Wyke Bayliss, P.R.S.B.A., Frank Bishop, G. H. Boughton, R.A., H. Scott-Bridgwater, Thomas Brock, R.A., Walter Dowdeswell, *Luke Fildes, R.A., A. C. Gow, R.A., Algernon Graves, F.S.A., *J. F. E. Grundy, O. Gutekunst, A. H. Haig, R.E., W. Hatherell, R.I., E. B. Haynes, Marcus B. Huish, Seymour Lucas, R.A., J. Macwhirter, R.A., W. Q. Orchardson, R.A., *Joseph B. Pratt, T. E. Scrutton, K.C., Cyril Spottiswoode, W. Reynolds-Stephens, Carmichael Thomas, Alexander Tooth, and Adolph Tuck.

SOLICITOR.—Herbert Voysey.
HONORARY TREASURER.—*C. Morland Agnew.
HONORARY SECRETARY.—*D. C. Thomson.
ASSISTANT SECRETARY.—John Major.

This Society has announced as its first activity "the endeavour to push through Parliament a Copyright Bill, such as will be acceptable to its members and beneficial to the community at large."

* These form the Executive Sub-Committee.

EXTRACTS FROM THE RULES.

That the Society is formed with the object of promoting the interests of all concerned in artistic copyright.

That the attention of the Society shall be specially directed to the improvement, amendment, and codification of the laws relating to artistic copyright in the United Kingdom, and to the promotion of a Bill in Parliament to that end, and eventually to induce the Colonial Legislatures to bring their copyright laws into line with those of the United Kingdom.

That a further object of the Society shall be to take such steps as may be deemed necessary or advisable to prevent piracy or infringement of artistic copyrights, and

To give information on copyright questions to members of the Society.

That painters, sculptors, architects, designers, engravers, owners of works of art, print publishers, print sellers, dealers in works of art, photographers, and all interested in the subject of artistic copyright shall be eligible for membership of the Society.

That election of members shall be vested in the Committee. Application for membership to be made to the Honorary Secretary in writing.

That the annual subscription be £1 1s., payable on January 1.

THE NATIONAL PHOTOGRAPHIC RECORD ASSOCIATION.

PRESIDENT.—Sir J. Benjamin Stone, M.P.

HON. SECRETARY.—Geo. Scamell, 21, Avenue Road, Highgate, London.

The Association has been founded for the purpose of forming a National Photographic Record of existing objects of interest throughout the British Isles. The photographs are intended to be deposited in the British Museum for public reference. The photographs are in no way restricted to archæological subjects, but include ethnological, geographical, geological subjects, etc. The Central or Standing Committee will receive all prints for the British Museum collection, and, if approved, will mount and deposit them in the British Museum. All arrangements for deposits in county or other museums will be left to local Societies that have undertaken the photographic survey of their respective counties. Prints to be in platinum or some other permanent process, and whole plate, $8\frac{1}{2} \times 6\frac{1}{2}$, to be considered standard size.

THE LINKED RING.

THE Linked Ring is composed of a number of photographic workers with artistic aims. They conduct the Photographic Salon, an annual exhibition of selected pictures at 5A, Pall Mall East, London, W.C. The members of the Linked Ring are as follows:—C. Yarnall Abbott, A. Alexandre, Bernard Alfieri, J. Craig Annan, Ernest R. Ashton, W. Smedley Aston, Harold Baker, Walter Benington, Shapoor N. Bhedwar, David Blount, F. A. Bolton, Maurice Brémard, Tom Bright, Maurice Bucquet, Arthur Burchett, A. Buschbek, W. A. Cadby, Mrs. Carine Cadby, Eustace Calland, H. Hay Cameron, Lyonel Clark, A. L. Coburn, Archibald Cochrane, Hector Colard, Walter L. Colls, Reginald Craigie, J. Cruwys-Richards, L. David, George Davison, F. Holland Day, Robert Demachy, Mary Devens, W. B. Dyer, R. Eickemeyer, Charles Emanuel, Frank Eugene, Frederick H. Evans, Col. J. Gale, John Pattison Gibson, Karl Greger, Georges Grimprel, J. M. C. Grove, Hugo Henneberg, A. Hildesheimer, A. Horsley Hinton, Frederick Hollyer, Charles Job, Mrs. Gertrude Kasebier, Alexander Keighley, Joseph T. Keiley, Heinrich Kühn, Rouillé Ladevèze, Viscount Maitland, Thomas Manly, Alfred Maskell, Baron A. de Meyer, Charles Moss, Ward Muir, C. Puyo, Ralph W. Robinson, Mrs. Margaret Russell, Otto Scharf, Mrs. E. L. Watson-Schütze, Mrs. Sarah C. Sears, Dr. F. von Spitzer, Eduard J. Steichen, Alfred Stieglitz, Edmund Stirling, J. Strakosch, Frank M. Sutcliffe, Carl Ulrich, J. B. B. Wellington, H. Van der Weyde, Clarence White, and W. Willis.

Secretary of the Linked Ring:—Frederick H. Evans, 34, Fox Hill, South Norwood, S.E.

Secretary of the Photographic Salon:—Reginald Craigie, Corner Cottage, Wimbledon Common, S.W.

THE AFFILIATION OF PHOTOGRAPHIC SOCIETIES

WITH THE ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN.

CHAIRMAN.—The Right Hon. the Earl of Crawford, K.T., F.R.S.

CHAIRMAN OF EXECUTIVE COMMITTEE: C. H. Oakden, F.R.P.S.

SECRETARY.—J. McIntosh, 66, Russell Square, London, W.C.

BENEFITS AND PRIVILEGES.—Affiliated Societies are entitled to the following benefits and privileges:—

The loan of illustrated lectures on photographic and kindred topics, sets of lantern slides, lantern lectures, pictures for exhi-

bition, etc., and interchange of lectures and lecturers between the affiliated societies.

Permits to photograph (see below).

Two copies of each issue of the "Photographic Journal," in which are published the proceedings of the Affiliation Committee, the Transactions of the Royal Photographic Society of Great Britain, etc.

Admission to the Annual Exhibition of the Royal Photographic Society of Great Britain at reduced prices.

Members of affiliated societies joining the Royal Photographic Society of Great Britain receive exemption from the payment of entrance fee, provided they have been for at least two years members of an affiliated society. The secretaries and delegates of affiliated societies are empowered to propose and second the nominations of such candidates.

Temporary use of the accommodation provided by the various societies to members away from their own districts.

Annual competitions of pictorial photographs and lantern slides are arranged.

Judges of Competitions.—A Board of Judges is prepared to meet three or four times per annum, at 66, Russell Square, to adjudicate upon competitions arranged by affiliated societies. The exhibits must be sent to the secretary with full details of the competition, and it is to be understood that the judges will follow the rules adopted by the conference of judges (see below). The judges will not undertake to criticise any work submitted.

Management.—Every affiliated society has a voice in the management of the affiliation through the two delegates which each is entitled to appoint. The general body of delegates meet at least twice a year, the business in the meantime being conducted by an executive committee. The two delegates appointed by each society need not necessarily be members of the society they represent. The Royal Photographic Society of Great Britain reserves one-third of the amount of the subscriptions for secretarial, clerical, and incidental working expenses. The affiliation committee have the remaining two-thirds entirely at their disposal.

Permits to Photograph.—Arrangements have been made whereby members of affiliated societies will be permitted to photograph in or at the following places without other formality than the production of the Red Book (which is non-transferable), if required by those in charge. This permission is subject to any special arrangements that may be made from time to time by the

authorities, and it should be understood that these concessions are granted as a matter of grace and not as rights. Holders of the Red Book are expected to act accordingly :—Bristol Cathedral, Hereford Cathedral, Lichfield Cathedral, Romsey Abbey, Burnham Beeches, *Bushey Park, Coulsdon Common, Farthingdown, Kenley Common, Riddlesdown, West Wickham Common, *Green Park, *Greenwich Park, *Hampton Court Park, Gardens and Green, Highgate Wood, *Hyde Park, *Kensington Gardens, *Kew Green, Queen's Park (Kilburn), *Natural History Museum Gardens, *Parliament Square Gardens, *Primrose Hill, *Regent's Park, *Richmond Park and Green, *St. James's Park, St. Paul's Churchyard (to 12 noon), *Victoria Tower Gardens.

The societies forming the affiliation are indicated by a * in the list of photographic societies preceding and following.

Conference of Judges.—The following rules and recommendations concerning photographic exhibitions, adopted by a meeting of judges, convened by the affiliation on April 11, 1900, and revised in June, 1903, have received the approval of the judges, whose names are published annually in the Photographic Red Book. The committee of the affiliation entertain the hope that every affiliated society will endeavour to conform to them as closely as possible. The rules are known to have proved decidedly beneficial in the past.

Rules.—1. The judges' decision upon the merit of the exhibits shall be final, and they shall not be asked to decide any other point.

2. The judges shall have full power to withhold any award, and this shall be stated in the prospectus.

3. The judges shall have power to exclude all persons from the room while judging.

4. The judges' expenses shall be paid.

5. The judges shall not adjudicate upon pictures exhibited as produced with wares of special trading firms.

6. No award shall take the form of a money prize.

7. Where there is a champion class, pictures which have previously taken awards in Open classes shall be exhibited in the champion class only.

8. An award shall be made to one picture only, whether it is in print, lantern slide, or other form; but in cases where the exhibition rules provide for slides to be exhibited in sets, the award shall be made to the best slide in the best set.

9. There shall be no distinction between amateur and professional.

10. No production of any kind whatever from the same negative shall receive more than one award at the same exhibition. This includes lantern slides, enlargements, etc.

11. No award shall be made to a lantern slide until it has been projected on the screen.

12. No award shall be given for pictorial work that is not solely the work of the exhibitor, and it shall be stated on the entry

* In those places indicated by an asterisk only *hand cameras* may be used under this permit, and the photographing of persons or groups is not permitted

form to what extent the work sent for competition is that of the exhibitor.

13. That the names of those who have consented to act as judges shall be printed in the prospectus of the exhibition.

RECOMMENDATIONS.—14. Where the judges make more than one award to the same competitor, all these should be published in the award list, although there be an exhibition regulation debarring a competitor from receiving more than one prize.

15. The judges should have power to give extra awards where they may think fit.

16. In order to enhance the value of awards their number should be limited.

17. The Exhibition Committee should not accept offers of awards from trading firms.

18. It is desirable not to have classes. Where there are classes their number should be kept as small as possible, and divisions, where made, should be entirely respecting "subject," such as portraiture, landscape, etc., and not such as hand camera classes, enlargement classes, etc.

THE SCOTTISH PHOTOGRAPHIC FEDERATION.

PRESIDENT.—G. D. Macdougald, F.I.C.

SECRETARY.—John B. Maclachlan, Blairgowrie.

This Federation is open to all Scottish societies, including photographic sections of scientific and other societies, also to unattached photographers. Its object is to consider and provide means for the mutual benefit, encouragement, and protection of the federated societies, their members and individual photographers attached to the Federation. Special features of the organisation are the photographic "experts," who have been appointed to advise associates on various photographic matters, and "reporters," who represent the Federation in the various districts described in the Gazetteer in the "Blue Book." The "Blue Book" is the official certificate of associate-ship and contains full particulars and information concerning the Federation. The Federation promotes annually The Scottish National Photographic Salon—the representative Scottish photographic exhibition. The 1906 exhibition will be held at Dundee, January 13 to February 3, in the Albert Galleries (Salon Secretary, V. C. Baird, Broughty Ferry).

The federated societies are as follows:—Aberdeen Photographic Association, Aberdeen Photographic Art Club, Airdrie (Monklands), Photographic Society, Arbroath Camera Club, Barrhead Amateur Art Club, Blairgowrie and District Photographic Association, Bonnybridge Amateur Photographic Association, Brechin Photographic Association, Carnoustie Photographic Association, Coatbridge Co-operative Camera Club, Crieff Photographic Association, Denny and District Photographic Association, Dumfries Photographic Association, "Dundee Advertiser" Photographic Club, Dundee and East of Scotland Photographic Association, Edinburgh University Photographic Society, Glasgow Eastern Amateur Photographic Association, Glasgow Eastern Co-operative Camera Club, Glasgow Southern Photographic Association, Glenalmond Photographic Club, Grangemouth Amateur Photographic Association, Greenock Camera Club,

Hamilton Photographic Association, Kinning Park Co-operative Govan Camera Club, Kirkcaldy Photographic Society, Kirriemuir Amateur Photographic Society, Larkhall Camera Club, Motherwell Young Men's Institute Camera Club, Muirkirk Amateur Photographic Association, Outer Hebrides Photographic Society, Paisley Philosophical Institute (Photographic Section), Perthshire Society of Natural Science (Photographic Section), Shettleston Camera Club, Shotts Camera Club, St. George's Co-operative Camera Club, Stirling and District Photographic Club, West Calder Camera Club, Wishaw Photographic Association.

Particulars of these societies will be found under "Photographic Societies."

THE YORKSHIRE PHOTOGRAPHIC UNION.

PRESIDENT.—Godfrey Bingley.

SECRETARY.—Ezra Clough, 10, Farncliffe Road, Bradford.

The following are the main objects of the Union:—

1. Intercourse and exchange of opinion between the members of one society and another.
2. United action for the pnrposes of exhibitions, or dealing with any questions of importance to photographers connected with the Federation—such as questions of principle relative to railway charges, etc.; privileges for working in places of interest not open to the general public, etc.
3. Interchange of prints and lantern slides.
4. Interchange of lecturers and lectures.
5. An annual excursion.
6. An annual meeting, to be held at some important centre during the month of April, and taking the form of an exhibition, a conversazione, or otherwise, as circumstances may render desirable.
7. Special railway fares.
8. Competitions in different branches of photography.
9. The provision of a staff of judges, available for exhibitions and competitions.

A list of lecturers and available lectures is published annually.

Societies comprising the Union:—Batley Photographic, Birstall Photographic, Bradford Photographic, Brighouse Photographic, Burnley Camera Club, Cleveland Camera Club, Colne Camera Club, Crossgates Camera Club, Dewsbury Photographic, Doncaster Camera Club, Halifax Camera Club, Harrogate Camera Club, Holmfirth Photographic, Huddersfield Photographic, Hull Photographic, Idle Photographic, Ilkley Photographic, Keighley Photographic, Leeds Camera Club, Leeds Photographic, Morley Photographic, Nelson Photographic, Otley Camera Club, Pudsey Photographic, Redcar Photographic, Rodley Photographic, Scarboro' Photographic, Sheffield Photographic, Skipton Photographic, Wakefield Photographic, York, Photographic Society.

Particulars of these Societies will be found under "Photographic Societies."

THE FEDERATION OF THE PHOTOGRAPHIC SOCIETIES OF NORTHUMBERLAND AND DURHAM.

SECRETARY.—J. B. Scott, 1, Bedford Terrace, Bedford Street, North Shields.

The objects of the Federation are the interchange of lecturers and

lectures, etc. Intercourse and exchange of opinions between the members of the societies and special privileges obtained by united action. Co-operation for the purposes of exhibition, etc. The societies included in the Federation are as follows—Bishop Auckland P. S., Blaydon C. C., Consett P. S., Crook & District C. C., Darlingtou C. C., Gateshead C. C., Gateshead Teachers N.H.S. (P. S.), Hartlepool P. & S. S., Jarrow C. C., Newcastle & N. C. P. A., Seaham & District C. C., South Shields P. S., Sunderland C. C., Tynemouth P.S.

Particulars of these societies will be found under "Photographic Societies."

THE AMERICAN FEDERATION OF PHOTOGRAPHIC SOCIETIES.

SECRETARY.—Wm. T. Knox, 279, Washington Street, New York City, U.S.A.

Founded for the advancement of pictorial photography, the encouragement of photographic record, etc. The American Salon is promoted annually by the Federation, and after the first exhibition in New York makes a tour of some twelve leading centres. In Washington the Salon is held in the Concoran Galleries, in Pittsburg in the Carnegie Institute, in Chicago in the Arts' Institute. The Federation includes at present about twenty photographic societies.

THE PHOTO-SECESSION.

DIRECTOR.—Alfred Stieglitz, 1111, Madison Avenue, New York, U.S.A.

Place of Meeting, 291, Fifth Avenue, New York. The Secession holds continuous exhibitions.

PHOTOGRAPHIC SURVEY ASSOCIATIONS.

PHOTOGRAPHIC SURVEY OF EDINBURGH AND DISTRICT.

SECRETARY.—Jas. Burns, Edinburgh Photographic Society, 38, Castle Street, Edinburgh.

PHOTOGRAPHIC SURVEY OF ESSEX.

SECRETARY.—V. Taylor, Essex Museum of Natural History, West Ham.

PHOTOGRAPHIC SURVEY OF KENT.

SECRETARY.—J. H. Allchin, County Museum, Maidstone.

PHOTOGRAPHIC SURVEY AND RECORD OF SURREY.

PRESIDENT.—Rt. Hon. Viscount Midleton.

SECRETARY.—Frank F. Wood, 22, Mint Walk, Croydon.

PHOTOGRAPHIC SURVEY OF WARWICKSHIRE.

PRESIDENT.—Sir J. Benjamin Stone, M.P.

SECRETARY.—Geo. Whitehouse, 7, Wye Cliff Road, Handsworth, Staffs.

PHOTOGRAPHIC SURVEY OF WORCESTERSHIRE.

SECRETARY, Walter W. Harris, 101, High Street, Worcester.

COLONIAL PHOTOGRAPHIC SOCIETIES.

Adelaide Amateur Camera Club.—*Pres.*, T. B. Ragless. *Meetings*, Citizens' Offices, City, alternate Wednesdays, 8 p.m. *Sec.*, A. C. R. Stephen, Citizens' Offices, City, Adelaide, South Australia.

***Amateur Photographic Association of Victoria.**—*Pres.*, H. C. Mais, M.Inst.C.E. *Meetings*, Furlong's Studio, Royal Arcade, Melbourne. *Sec.*, D. W. Paterson, 487, Collins Street, Melbourne.

Auckland Camera Club.—*Pres.*, E. W. Payton. *Meetings*, 55, Victoria Street, Auckland. *Sec.*, Arthur Graham, Karangahape Road, Auckland.

Ballarat Camera Club.—*Pres.*, R. G. Radcliff. *Meetings*, Club Rooms, Lydiard Street, Ballarat, Second Tuesday in month. *Sec.*, H. A. Mackenzie, Lydiard Street, Ballarat, Victoria.

Bathhurst Amateur Camera Club.—*Pres.*, E. T. Webb. *Meetings*, Second Thursday each month. *Sec.*, H. J. Baldwin, Bathhurst, New South Wales.

Beechworth Camera Club.—*Pres.*, C. Hembrow. *Meetings*, Public Library, Beechworth, Victoria, Second Thursday in each month, 8 p.m. *Sec.*, R. W. Lover.

Bendigo Amateur Photographic Association.—*Pres.*, Jas. H. Crump. *Meetings*, School of Mines. *Sec.*, Jas. Miller, Bath Corner, Bendigo, Victoria, Australia.

Bombay Photographic Society.—*Pres.*, Prof. T. K. Gajjar, M.A., B.Sc., F.C.S., etc. *Meetings*, The Techno-Chemical Laboratory, Girgaum, Bombay. *Secs.*, Bomanji Dorabji Padamji and Vasanji P. Dalal, M.A., B.Sc., Techno-Chemical Laboratory, Girgaum, Bombay.

***Cape Town Photographic Society.**—*Pres.*, Sir David Gill, K.C.B., F.R.S., etc. *Meetings*, Y.M.C.A. Buildings First Thursday in each month. *Ex.*, February 4, 1906. *Sec.* A. J. Fuller, P.O. Box 470, Cape Town.

Castlemaine Amateur Camera Club.—*Pres.*, H. McBean. *Meetings*. School of Mines, Castlemaine, alternate Wednesdays. *Sec.*, C. A. Northcote, Market Square, Castlemaine, Victoria.

***Christchurch Photographic Society.**—*Pres.*, G. W. Bennett. *Meetings*, 154, Worcester Street, Christchurch, N.Z. *Sec.*, A. H. Gilby, Union Bank, Christchurch, N.Z.

Dai-Nippon Shashin Kyokwi (Photographic Association of Japan). — *Pres.*, H. E. Viscount M. Nagaska. *Meetings*, Kwazoku-Kwaikan, 1, Uchiyamashitacho, Tokyo. *Sec.*, K. Ogura, 77, Minami-Enokimachi, Ushigome, Tokyo.

***Dunedin Photographic Society.**—*Pres.*, W. Gow. *Meetings*, Liverpool Street, Dunedin, N.Z. *Sec.*, J. Stuart White, 98, Princes Street, Dunedin, N.Z.

East Malvern Amateur Photographic Club.—*Pres.*, Rev. J. B. Gason. *Meetings*, St. John's Schoolroom, Finch Street, East Malvern, Victoria, Australia. *Sec.*, Sydney Fox, "Almalea," Dandenong Road, East Caulfield, Victoria.

Gordon College Amateur Photographic Association.—*Pres.*, H. G. Roebuck. *Meetings*, Gordon Technical College, Geelong. *Sec.*, C. T. Seeley, 83, Yarra Street, Geelong, Victoria.

Gulgong Amateur Photographic Association.—*Pres.*, H. C. Cross. *Meetings*, Association Room, Gulgong, alternate Thursdays. *Sec.*, A. P. Lambert, Gulgong, New South Wales.

Hamilton Association Camera Club, Canada.—*Pres.*, J. M. Eastwood. *Meetings*, Hamilton Association Rooms, Public Library. *Sec.*, W. Henry Edwards, 168, Main Street E., Hamilton, Ontario, Canada.

***Hawk's Bay Camera Club, N.Z.**—*Pres.*, F. W. Williams. *Meetings*, Club Room, Regent Street, Napier, Third Tuesday in each month. *Ex.*, October. *Sec.*, T. Bruce Bears, c/o Napier Gas Co., Ltd., New Zealand.

Ipswich Amateur Photographic Society.—*Pres.*, J. H. Barkell. *Meetings*, Second Friday in each month. *Sec.*, C. E. Greenham, Ipswich, Queensland.

***Johannesburg Photographic Society.**—*Pres.*, J. Percy Fitzpatrick. *Meetings*, Reliance Buildings, Kerk Street. *Sec.*, H. C. Haddon, Box 4822, Johannesburg, Transvaal.

Kapunda Photographic Club.—*Pres.*, R. S. Hawke. *Meetings*, Club Rooms, School of Mines, Main Street, alternate Tuesdays, 7 p.m. *Sec.*, T. Warner, Chapple Street, Kapunda, South Australia.

***Maritzburg Camera Club.**—*Pres.*, D. M. Eadie. *Meetings*, Hardy's Chambers, First Wednesday and Third Thursday. *Sec.*, A. R. Hopkins, 4, Hardy's Chambers, Printing Office Street, Pietermaritzburg, Natal.

Melbourne Working Men's College Photographic Club.—(ESTABLISHED 1902.) — *Pres.*, Professor Kermot, M.A., M.E. *Meetings*, Latrobe Street, Melbourne, each alternate Thursday, 8 p.m. *Sec.*, Arthur J. Relph, Gov. Printing Office, Melbourne, or 33, Palermo Street, South Yarra.

Montreal Camera Club, Canada.—*Pres.*, George Sumner. *Meetings*, 4, Phillip's Square, Montreal, Canada. *Sec.*, A. Clarence Lyman, 157, St. James' Street, Montreal, Canada.

Nelson Camera Club.—*Pres.*. C. T. Fell. *Meetings*, every Third Monday in month. *Sec.*, A. H. Patterson.

New South Wales Railway and Tramway Camera Club.—*Pres.*, H. Maclachan. *Meetings*, Railway Institute, Radfern, First Monday in each month. *Sec.*, J. Scoular, Railway Institute, Radfern, N.S.W.

Northern Suburbs Camera Club, New South Wales.—*Pres.*, W. A. Gullick. *Meetings*, Pymble Club Hall, Third Monday in each month, 8 p.m. *Sec.*, N. McIntosh.

***Northern Tasmanian Camera Club.**—*Pres.*, R. C. Kermode. *Meetings*, Launceston, Tasmania. *Sec.*, F. Styant Brown, 112, Brisbane Street, Launceston, Tasmania.

Perak Amateur Photographic Society.—*Pres.*, L. Wray, M I.E.E., F.Z.S., etc. *Meetings*, Poverty Flat, Museum Road, Taiping. *Sec.*, Geo. Bain, Taiping, Perak.

Photographic Association of Canada.—*Pres.*, H. S. Park. *Meetings*, London, Ontario, Canada. *Sec.*, Thomas D. Hastings, 169, Dundee Street, London, Ontario, Canada.

Photographic Employees' Association of N.S.W.—*Pres.*, James C. Cruden. *Meetings*, Queen's Hall, Pitt Street, Sydney. *Sec.*, John Stewart, Alfred Street, North Sydney.

***Photographic Society of India.**—*Pres.*, Arthur F. Norman. *Meetings*, 10, Chowringhee, Calcutta. *Sec.*, T. R. Pratt, 6, Theatre Road, Calcutta.

***Photographic Society of New South Wales.**—*Pres.*, His Honour Judge Docker. *Meetings*, 149, King Street, Sydney. *Sec.*, F. E. Manning, Box 829, G.P.O., Sydney, N.S.W., Australia.

***Queensland Photographic Society.**—*Pres.*, W. C. Voller. *Meetings*, Technical College, Ann Street, Brisbane. *Sec.*, T. F. Illidge, 104–106, Eagle Street, Brisbane.

St. John Camera Club, Canada.—*Meetings*, 65, William Street, St. John, New Brunswick. *Sec.*, J. Kaye Allison, P.O., Box 401, St. John, N.B., Canada.

***South Australian Photographic Society.**—*Pres.*. A. Vaughan. *Meetings*, Institute Building, Adelaide. *Sec.*, H. E. Powell, S.A. Society of Arts Rooms, Institute Building, Adelaide.

Toronto Camera Club.—*Pres.*, Edmund E. King. *Meetings*, Forum Building, Yonge Street, Toronto, Ontario. *Sec.*, John J. Woolrough, 32, Cottenham Street, Toronto, Ontario, Canada.

Upper Canada College Camera Club.—*Meetings*, Upper Canada College, Toronto, Ontario. *Sec.*, O. M. Biggar, 249, Simcoe Street, Toronto, Ontario, Canada.

***Wanganui Camera Club.**—*Pres.*, C. W. Babbage. *Meetings*, Club Room, Ridgeway Street. *Sec.*, G. Bolton, Bank, New South Wales, Wanganui, New Zealand.

***Wellington Camera Club, N.Z.**—*Pres.*, A. de B. Brandon. *Meetings*, Exchange Buildings, Lambton Quay, Second Thursday in each month. *Sec.*, J. A. Heginbotham, Wellington, New Zealand.

West Australian Photographic Society (Perth).—*Meetings*, Third Wednesday in each month. *Sec.*, A. R. L. Wright, Public-Works, Department, Perth, West Australia.

AMERICAN SOCIETIES.

The list of American societies is withheld from the present Almanac, for the one reason of exigency of space but equally because a large number of secretaries failed to reply to our circular asking for particulars. It was therefore thought better to reserve the publication of a number of unverified names and addresses. Secretaries who did reply are thanked for their courtesy, and perhaps any officer or member of a society into whose hands the present volume may fall will kindly take the opportunity of communicating with the Editor or sending particulars such as are given in the case of each British society.

RECENT NOVELTIES IN APPARATUS, &c.

BY THE EDITOR.

[*These notices are confined as far as possible to apparatus introduced since the publication of the last Almanac. In all cases the various articles have come under our personal examination, a rule from which we allow no departure.*]

THE "SALEX" POCKET CAMERA.

(Sold by the City Sale and Exchange, 90-94, Fleet Street, London, E.C.)

This little camera is claimed to be an ideal one for ladies' use. It is small and light, and yet very complete. The body is made of an aluminium casting, and when closed the camera measures only $5\frac{1}{4}$ in. by $3\frac{1}{4}$in. by $1\frac{1}{2}$ in., yet gives sufficient extension to use the single combination of the lens. A novel point of the focussing pinion is that it may by a simple movement be locked at any point. The shutter is of a new pattern, and whilst we may describe it as being of the "Unicum" class, it differs from this shutter in many respects, the alteration of speeds being effected by a novel lever arrangement, and the shutter does not take up more than half the space of the "Unicum." The lens is a rapid aplanat by Clement and Gilmer, and works at *f*/8. It is fitted with iris diaphragm. An infinity catch is provided for quick focussing, and the scale is marked from this to 6 ft. A useful addition is a second scale for use with the back combination of the lens alone. Three light metal double dark slides are supplied with the camera, and the price is £3 15s. A Premo film-pack adapter or a changing box can be fitted to this camera if necessary.

THE "SERVICE" MULTIFOCAL PROJECTING LENS.

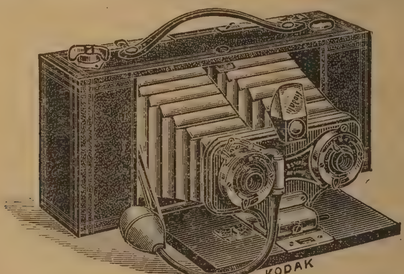
(Sold by the Service Photographic Society, 292, High Holborn, London, W.C.)

The "Multifocal," as its name implies, is a lens providing several focal lengths in the one instrument. It consists of an ordinary lantern projecting lens of 6 inches focus, behind which can be fitted a negative attachment. At the same extension from the condenser a focal length of 8 inches is obtained with the condenser *in situ*, and on greater separation of the negative attachment from the positive, with corresponding extension of the lantern front, foci up to 12 inches are obtained. The convenience of such a lens in meeting the exigencies of lantern exhibitions, scarcely needs emphasis, and the telephoto principle thus applied in conjunction with a powerful illuminant appears free from many of the drawbacks involved in it when employed for landscape purposes. The price of the multifocal, complete with hinged cap, is £3 15s.

THE STEREO-BROWNIE KODAK.

(Made by Kodak, Limited, 57-61, Clerkenwell Road, London, E C.)

The Stereo-Brownie is, as its name implies, yet another member of the popular Brownie family, and like the other Kodaks of this series is a well-made and excellently finished little instrument, with all that is necessary to fulfil its maker's claims. It is of simple construction, and weighs less than 30 oz. The pictures of the stereoscopic pair measure $2\frac{5}{8}$ in. by $3\frac{1}{4}$ in. each, and the camera can be loaded or unloaded in daylight with spools for ten, six, or



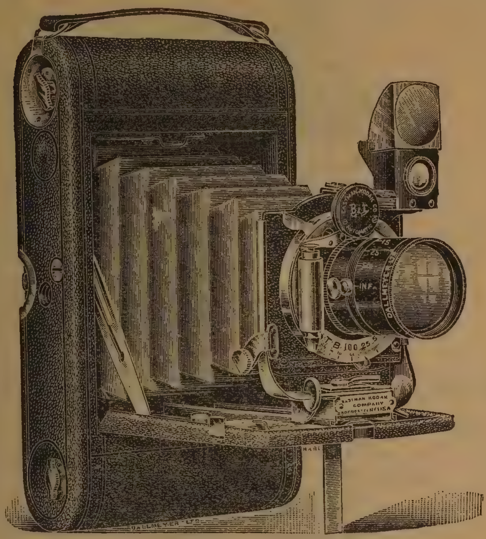
four pairs of exposures. A brilliant finder with hood and screw bush for tripod work is included, and the pair of single lenses supplied cover excellently at full aperture. Both diaphragms are actuated by one movement thus ensuring identical openings. The shutters are of the everset automatic type, and are released simultaneously by either trigger or bulb release. The focussing arrangement is novel. By an ingenious device it is possible to set the distance scale before drawing out the bellows, and the camera front then becomes automatically locked at the required focal distance. The complete apparatus costs only 50s.

A NEW "ADON" LENS.

(Made by J. H. Dallmeyer, Ltd., 25, Newman S reet, Oxford Street, London, W.)

A new form of the Adon telephoto lens is now made in three patterns. All three are intended for use on folding cameras of single or double extension, such as the Folding Pocket and Cartridge Kodaks, permitting large size images to be obtained with or without extension of the camera beyond the "infinity focus." The No. 1 instrument is made specially for the No. 3 F.P.K., the front lens of which is removed, leaving the back component—a single uncorrected glass—in the mount. With the Junior Adon the complete lens now acts at the normal extension as an objective of about double the focal length, and in doing this the attachment corrects the aberration of the back lens, with the result that the complete telephoto system gives very sharp and crisp figures. At the normal extension (the lens front at the infinity position) the corners of the plate are not quite covered, but at the slightly higher magnification obtained on racking out the camera, the covering power is complete. The rapidity of the F.P.K.

lens is practically unaltered by the addition of the "Adon." The No. 2 instrument is similar in use, though slightly different in construction, as it is made for the No. 3a F.P.K., Cartridge, and other



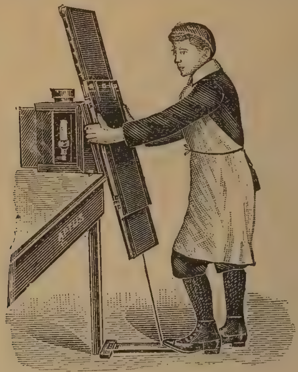
Kodak cameras, in which the back lenses are separately corrected. For double extension cameras the No. 3 "Adon" should be chosen, the extra extension enabling the makers to give the attachment a somewhat higher power. The price of either pattern, scaled for focussing, is 50s.

THE "APTUS" COMBINATION PRINTING FRAME AND LAMP.

(Made by Sharp and Hitchmough, Dale Street, Liverpool.)

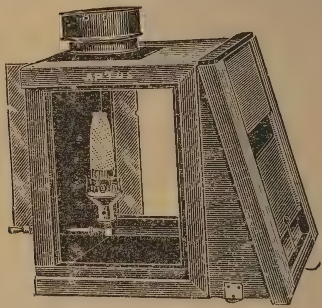
This printing frame has been specially designed for the production of large quantities of stamp and midget photographs in a very short time. The body of the frame consists of a long board containing a rebated opening to take the negative or negatives, which may be cut into strips before exposure in the stamp camera. On the surface of this long printing frame a pressure-board slides in grooves, and a sheet of bromide or gaslight paper is held in contact with it. The aperture in the frame is protected from the light in the lamp, against which it rests, by a flap actuated by a stirrup moved by the foot of the operator. The paper is exposed in strips the width of the aperture, and as each exposure is made the back

is slid up a space, and the negative exposed again. These spaces are determined automatically by side slots, and the whole process



is so simple that given multiple negatives, as many as five to six thousand stamp or midget prints can be produced with it in an hour.

The "Aptus" printing lamp is specially made for use with the above frame, but can be fitted to almost any flat printing frame on the market. An automatic cut-off for exposing rapidly is fitted to



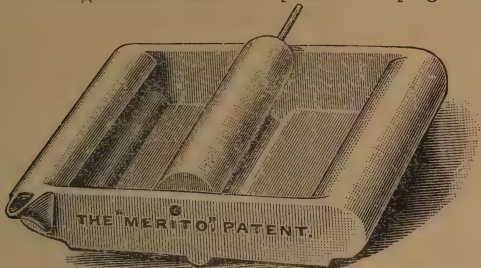
the lamp, and it has glass doors at the sides, so can be also used as a dark-room lamp. It is supplied complete with incandescent gas burner and with various sized openings.

THE "MERITO" NON-SPLASHING PHOTOGRAPHIC DISH.

(Sold by W. L. Parkinson, 62, Dale Street, Liverpool.)

The problem of sloppy developing dishes appears to have been successfully overcome in this new developing dish. It is well made of porcelain, and, as shown in the illustration, has each end covered in so that any reasonable amount of vigorous rocking will not cause

the least splashing of the developer over the sides of the dish. In addition to this, a sensible spout has been added to facilitate pouring off the solutions, and a ridge at the bottom assists in making rocking easy when the dish is placed on a table or other flat surface. The article is well made, and it is also supplied with a porcelain roller to go across the middle of the dish to fit in two holes at the sides for film development. This, combined with the decided advantage of being able to use it for plate developing without fear



of slopping the developer, should make it a very useful addition to the photographer's outfit. The dish is made in a new material, "Adamant Porcelain," strong and highly non-absorbent.

The price of the "Merito" dish is 1s. 3d. quarter plate size, or with roller for film development, 1s. 6d.

"APTUS" FLASHLIGHT APPARATUS.

(Made by Sharp and Hitchmough, Dale Street, Liverpool.)

This useful little piece of apparatus has been brought out to meet the demands for an easily portable flashlamp that can be employed

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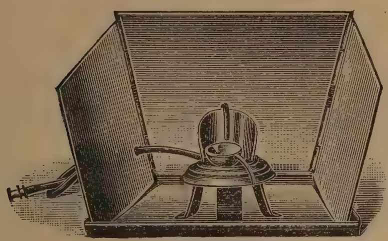


OPEN FOR USE

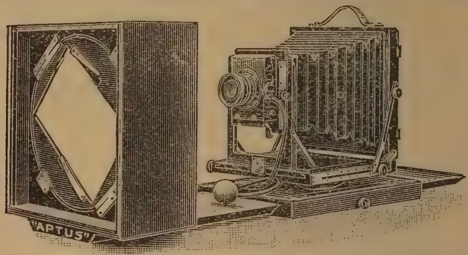
with very little waste. It folds into an extremely small compass, and opens automatically for use with any form of flashlight, acting both as a reflector and reservoir. It can be carried in the camera case

with half-plate or larger cameras, and used either with the "Aptus" or similar flash lamp, as shown in the illustration, or with flash candles it is very effective. A handle is fitted at the back to enable the operator to point the apparatus in any direction during the exposure. The flash is actuated by a tube led through the side of the reflector. It is supplied packed in card box at 3s.

THE "APTUS" COPYING AND REDUCING CAMERA.

(Made by Sharp and Hitchmough, Dale Street, Liverpool.)

The illustration explains the form of this piece of apparatus, which is intended principally for reducing from any size negative to lantern plate size. The stock pattern takes up to half-plate, but



any larger size will be supplied to order. It is fitted with a revolving negative holder, and costs, without camera, 25s. Purchasers can have their own cameras fitted at extra cost, or the complete apparatus, with camera, will be supplied at £4 2s. 6d.

"COOKE" SERIES II. AND SERIES IV. LENSES.

(Made by Taylor, Taylor, and Hobson, Stoughton Street Works, Leicester.)

These two new series of Cooke lenses are designed for high-speed photography, portraiture, and for the many occasions where critical definition at a large aperture over a considerable angle is required. The Series II. are designed to work at $f/4.5$, and the Series IV. at $f/5.6$. In construction, both series resemble the well-known Cooke lens, each consisting of three single glasses, a distinctive type, to which the makers ascribe rapidity over and above that of complex lens systems of the same nominal aperture. The image in each case on the focussing screen is beautifully sharp and brilliant; but, in order to obtain authoritative and delicate tests of the flatness of field and its anastigmatic correction, we append determinations made by the Department of Technical Optics of the Northampton Institute. As a standard of correction of these aberrations, Mr. S. D. Chalmers, the director of the department, adopts the following:—"The corrections are considered sufficient when (1) the astigmatic difference and (2) the departure of the image from the plane of the plate does not exceed 1mm. for each 100mm. focal length." Perhaps the English reader will grasp the degree of correction which this represents if we convert it into British measures:—1mm. in 100mm. is the same

thing as 1-20th of an inch for a 5-in. lens. We can now state the results as measured:—

Cooke Lens. Series II. F/4.5. Eight inches focal length.

Semi-angular Field.	Correction of astigmatism and curvature of field at full aperture, F/4·5.	
Degrees.	Astigmatism.	Curvature.
0	0.0	0.0
5	0.2	—0.1
10	1.0	—0.2
15	1.7	—0.4
20	.2	1.7

"Note.—The lens is excellently corrected up to 21 deg., covering a length of plate of 6 in. for a distant object. It falls off a little up to 6½ in., and then falls off very rapidly. For nearer objects the plate well covered would be slightly greater."

Perhaps the reader will not realise at once the practical meaning of these figures. Therefore we may point out that the greatest deviation of the field of the lens from the flat plate with which it should coincide is 1.7mm., or 1-16th of an inch, and this at the extreme edge of the plate. This flatness of field, it need hardly be said, is very satisfactory indeed in conjunction with the correction of astigmatism, which does not exceed the figure for curvature. We are not guilty of exaggeration in describing such an anastigmatic field as that of a lens of highly perfected manufacture. Messrs. Taylor, Taylor, and Hobson's special claim for these lenses is fine definition over a useful angle, and that we can say they have accomplished in the most successful manner.

The Northampton results with the Series IV. lens (8 in. focal length) are as follows:—

Semi-angular Field.	Astigmatism.	Curvature.
Degrees.	mm.	mm.
0	0	0
5	.2	.1
10	.8	.1
15	1.0	0
20	.4	—.8
22	2.4	—2.3

"The lens is excellently corrected up to 20 deg., covering a length of plate of 6 in. The definition is very good up to this point, falls off slightly up to a plate-length of 6½ in., the plate specified, but does not cover the corners of this plate at all satisfactorily."

With the above tests, thus stated frankly, must be mentioned a negative made by Messrs. Taylor, Taylor, and Hobson, of a test chart representing the definition across the diagonal of the half-plate, and we must confess that the definition is excellent, almost up to the corner. Possibly the Northampton test outruns the delicacy of the test object method of testing; but whether that is so or not, we are confident that the flatness of field does not suffer a departure from truth great enough to be discovered in practice with cameras

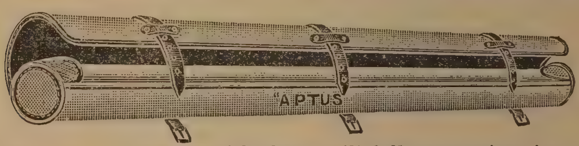
as commonly manufactured. In other words, we regard the two new lenses as possessing very strong claims upon the notice of photographers, and as making possible extremely fine work on every occasion when a large aperture is to be used.

Such a method of review as we have here adopted is, by its very nature, unfortunate, in that it states the errors and not the perfections of the lens, and unless the reader will study the figures as indications of the closeness with which the lens approaches the ideal in performance, he may be misled by them. Especially desirable is it in accepting such evidence of the quality of a lens, to have at hand data relating to the other instruments under comparison: for optical perfection is relative, not absolute, and the difference between lenses—often great, it is true—is nevertheless one of degree.

SOME "APTUS" NOVELTIES.

(Made by Sharp and Hitchmough, Dale Street, Liverpool.)

A lantern-sheet travelling case has been introduced by this firm, and those who have to travel much for the purposes of lecturing and



take their own apparatus with them, will fully appreciate its value. It is made of stout waterproof material, and wraps entirely round the rolled-up sheet. It is suitable for all lantern sheets and backgrounds, and sells at prices ranging from 12s. 6d. for 5 ft. long to 23s. for 12 ft. long.

The "Aptus" Plumb Indicator is a handy little accessory that costs but 6d., and its application to any camera is not only easy but will increase the efficiency of the instrument. It works very freely, and is well made.

"Aptus" Wood-Bottom Dishes.—These are made in various large sizes, and are, in ordinary use, unbreakable. They are specially intended for stamp and other photographic development work where large sheets of paper are handled, and are specially lined with chemical and waterproof material. They are very light and strong, and not expensive

THE ROSS 1906 MODEL TWIN-LENS CAMERA.

(Made by Ross, Ltd., Clapham Common, London, S.W.)

A new model of the well-known Ross twin lens camera embodies several new features which bring the instrument to a point of compactness beyond which it would seem impossible to go. By putting the focussing pinion above the baseboard the height of the two stories of the camera is reduced to 7 in., the total bulk of the quarter-plate size, as carried, being thus only 5 x $5\frac{1}{2}$ x 7 in. The front is fitted with a pair of doors, each door hinged at one side, and the

pair automatically springing open when a catch is released. The baseboard of the camera moves in grooves on the inside of these doors, so that the lens front is very rigidly held at any point of its extension. The front carrying its pair of lenses has considerable rise, the movement being by rack and pinion. The upper or finder camera has a new shape of hood, whereby the user can examine the picture on the ground-glass at a slight angle, instead of from the rather more awkward position directly overhead. The camera is adapted for dark slides or a changing box, and is supplied with a pair of Ross "Homocentric" or Ross-Zeiss "Tessar" lenses. The price of the quarter-plate camera, with three slides, and the pair of *f*/8 "Homocentrics" is about £17.

COPPER DARK-ROOM LAMPS.

(Sold by Sanders and Crowhurst, 71, Shaftesbury Avenue, London, W.)

Two sizes of copper lamps for electric light are made of the D shape shown in the figure, and, without embodying any distinct tively novel feature, are of excellent manufacture, well-ventilated,

and light-tight in all respects. The lamps are sold as the "Practical," and, fitted with ruby glass and yellow fabric, cost 9s. 6d. and 13s. 6d., or, with Sanger-Shepherd safe-light, 14s. 6d. and 18s. 6d.

THE KODAK RAPID PRINTER.

(Sold by Kodak, Limited, 57-61, Clerkenwell Road, London, E.C.)

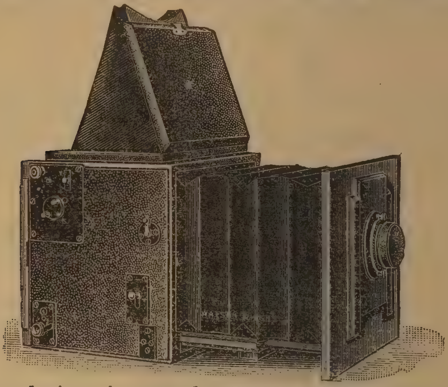
The convenience of exposing bromide prints in the dark room without disturbing the conditions of illumination is one which makes for comfort as well as for rapidity. Eye-strain, it has been found, is caused by constant change from the yellow or red light into a brighter and white light more than by prolonged work in a non-actinic illuminant. There is thus a double reason for adopting the system of exposing bromide paper, which the apparatus of Messrs. Kodak, Limited, provides. The "Printer" consists of a ruby-windowed chamber, containing an incandescent gas burner, the

light of which is scattered by reflection from a surface of white enamel paint, and reaches the negative through ground glass. The result is an equal distribution of the light, which, except through the red or yellow filter, never escapes into the dark room. The printer is made in two sizes—for whole plate (price £1 17s. 6d) and for 12 x 10 (price £2 7s. 6d.). In each case smaller negatives can be printed just as conveniently as those of the full size for which the apparatus is made, and the sensitive paper is adjusted in place on the negative by yellow light.

THE "ARGUS" REFLEX FOCAL-PLANE CAMERA.

(Made by W. Watson & Sons, 313, High Holborn, London, W.C.)

This camera has been put on the market to supply the wants of those workers who require a reflex camera of the usual high standard of Messrs. Watson's productions, but with a square reversing back, which last year's pattern did not possess. By an ingenious arrangement of levers the full-sized finder is obscured for an extremely brief



period only, during the actual exposure of the plate. The image can therefore be focussed right up to the instant of exposure, and can be observed on the ground glass of the protected finder, not only immediately before exposure, but immediately after. A deeper focussing hood, not that shown in the figure, is a feature. In the pattern before us the hood is 10 in. from aperture to screen, and is thus extremely convenient in use, while yet folding up to the space of the previous pattern. The body of the camera, which is of mahogany, is covered in black morocco leather; all uncovered parts are ebonised, and the metal fittings are finished black, rendering it as unobtrusive as possible. In the quarter-plate size the dimensions of the new square reversing back model are $5\frac{7}{8}$ by $6\frac{1}{4}$ by $7\frac{1}{4}$, which is extremely small for a camera with the qualifications this one possesses. It weighs but $2\frac{3}{4}$ lb., and has a bellows extension of 11 in. It is supplied with the Holostigmat lens, and the extension is sufficiently long to take the single combination. The focal-plane shutter gives "time" exposures of any duration, and instantaneous exposures from 1-15th to 1-1200th of a second. The alteration of the

slit is made from outside, and the speeds can be ascertained at a glance. The camera (square form), complete with Holostigmat lens and three dark slides, sells at £18 for the quarter-plate size, £20 11s. for 5 by 4, and £24 for half-plate.

A STUDIO KNIFE.

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

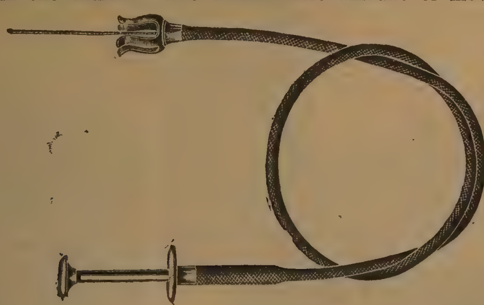
A very handy knife for the studio of the form shown in the figure is sold at 1s. The blade, 2 in. in length, is ground to a fine point,

and should be found of constant service in trimming prints, cutting masks, etc., or, if kept for the one purpose, for knifing negatives.

"ANTINOUS" RELEASE FOR HAND CAMERAS.

(Made by W. Watson & Sons, 313, High Holborn, London, W.C.)

This latest model of the "Antinous" all-metal release is specially made for small hand-cameras of the folding pattern. Its particular features are its lightness and flexibility, small proportions, and the method of attachment. The claw-fitting which fastens over the nipple of the shutter is made loose with a ball and socket motion, so that it is not strained when the release is held away from the camera. The considerable amount of movement in



the thrust of this release makes it adaptable to any of the diaphragm shutters fitted with a piston. For shutters that have no piston but a trigger only, the original automatic "Antinous" pattern with loop is still available. The price of the "claw" pattern is the same as that of the other varieties of the "Antinous."

THE "ACTINOLUX" PROCESS LENS.

(Made by W. Watson & Sons, 313, High Holborn, London, W.C.)

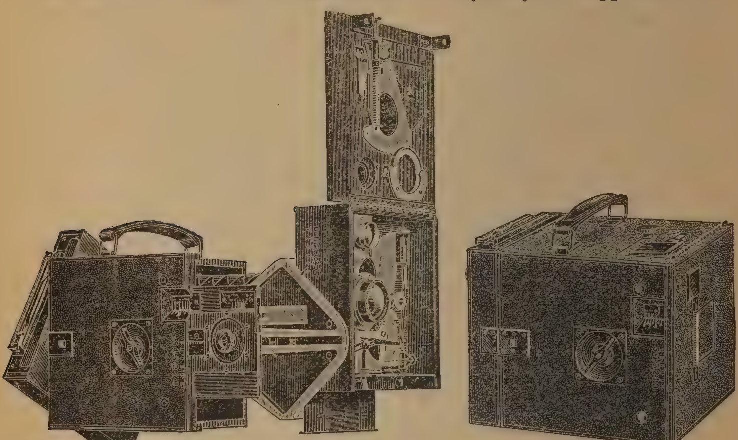
The above is a new lens designed for process workers, its special feature being the thinness of the glasses and their great transparence to ultra-violet light. Arc lights of the "enclosed" pattern and

mercury vapour lamps are coming into general use among photo-engravers, and Messrs. Watson's lens is for the purpose of shortening exposures by rendering available a large proportion of light which is usually stopped by the lens. Some results which we have seen certainly bear out their claims for the rapidity of the lens over and above that of its fellows working at the same nominal aperture. The lenses are made to cover the plates for which they are listed at $f/11$; larger sizes, with a smaller stop. The sizes and prices at present made are:—17 in. for 12 by 10, £9; 21 in. for 15 by 12, £12; 26 in. for 18 by 16, £16; 34 in. for 24 by 20, £25.

THE "N AND G" DE LUXE CAMERA.

(Made and sold by Newman & Guardia, 90 and 92 Shaftesbury Avenue, London, W.)

A camera which should be an improvement on the well-known "Universal" box instrument made by Messrs. Newman and Guardia for the past fourteen years might well be deemed impossible at the first onset, for we are not likely to be accused of overstating the case when we describe it as the recognised standard apparatus of this class, embodying the greatest number of useful movements and made with a regard to working efficiency beyond criticism. The present camera is not placed on the market in any way to supplant the



"Universal." It is the result of improvements in details undertaken in some cases for individual photographers and in others in designing the "N and G" reflex camera. As a result of these various items in the direction of bettering the camera by giving it a greater range of movement, by making its bulk smaller, or by saving time in employing it, we have a new model, or rather two new models, which are issued under the title "De Luxe." Messrs. Newman and Guardia feel somewhat sensitive as to the interpretation which shall be put upon their name for the instrument. They do not wish it thought

that the camera is "De Luxe" in the sense of being ornate, ornamental, or embellished in outward appearance. The additional features in the camera are photographic ones, introduced to save time, or improve the results. They therefore hold that the camera may be considered a luxury, inasmuch as the purchaser pays money for personal conveniences of a kind which he might dispense with, with no detriment to his work in using the "Universal" pattern. That this is a somewhat modest view to take will be gathered from our account of the several respects wherein the new model exceeds the standard pattern.

Let us say at once that in general design both the new models resemble the "Universal." Both are of the box pattern, and both are double extension, permitting the use of the single component of the lens. One difference in the two new models lies in the back and the accommodation of the dark slides, etc. In one, the closed back of the "Universal" is retained, and the camera is thus named the "Closed Back De Luxe." This design provides a light-tight chamber at the rear of the camera in which a changing-box, roll-holder, or several dark slides are carried without the slightest fear of fog from extraneous light. In the other new model this same safety is provided whilst yet making the back of the open pattern, like that of the "N and G" reflex. The result is, of course, that the length of the camera is very considerably reduced, and the back is adapted to take any kind of exposing device. Thus a worker can carry as separate fittings, a film-pack, a changing box, a roll-holder, dark slides, or such other apparatus as the MacKenzie-Wishart daylight slide, and use one or other of them without the slightest alteration to the camera. These accessories are adapted by Messrs. Newman and Guardia, and can then be used interchangeably.

The outstanding additions common to both varieties of the De Luxe camera are as follows:—Reversing back, large rising front, finder marked to work with rising front, instant change from single to double extension, greater range of exposure (1 to 1-200th second), and depth of field index on the focussing scale.

Taking these points in the above order, the camera is built square, and is therefore always held in the same position. The finder is marked to show the exact view included for horizontal and vertical pictures both with the complete lens and the single component. The back being mounted on a turntable, the position of the plate is made upright or landscape in a moment, and with the dark slide or changing box in position.

The lens is given $1\frac{1}{4}$ in. rise, and is moved by a smooth screw action, which permits the exact point to be reached to a nicety. In conjunction with the movement, the finder is marked with a series of horizontal lines by which the front can be raised to exactly the amount required to include a given object. The line below which the object in question conveniently falls (to about the extent which it is desired to fall below the upper edge of the plate) is noted, and the front of the camera at once raised to the same number on a scale at the side of the instrument.

The cameras are fitted with the Zeiss VIIa. No. 4 Protar, with aperture of $f/6.3$ at 5 in. focus and $f/12.5$ at 9 in. The change from single to double extension is made by a special sliding movement, by

which the lens board passes direct from the infinity, or any other position for one lens, into that for the other. The rack and pinion focussing gear is employed at either extension.

An entirely new pattern of shutter is used. It is of the between-lens type, giving a range of exposures from 1 second to 1-100th of a second. A new adjustment which makes for the comfort of working the camera is a disappearing setting knob, which shows the worker that his shutter is ready for an exposure. The speed alteration and regulation are by a double action pneumatic system, and, as in the other patterns of "N and G" cameras, the whole mechanism is accessible.

The focussing scales of the camera are marked with depth of field indicators showing the greatest and smallest distances from the camera which are in focus when the scale is set to any intermediate distance, and for any stop from *f*/6 to *f*/32.

The above itemized account of the new models will absolve us from any commendations of the design of the cameras which we might be disposed to pass: it is sufficient that we state the facts baldly and allow the practical worker of a hand-camera to judge for himself. In the matter of workmanship and accuracy of adjustment, we might follow the same course were we addressing only those who had had experience of the scrupulous care expended upon the adjustment of any piece of "N and G" apparatus before it leaves the warehouse. Those who have not this experience to go by may receive our own endorsement of the claims of the makers for scientific precision in the final adjustment of scales, finders, etc., and for mechanical excellence in the working of the metal and woodwork. An article in last year's "Almanac," it may be remembered, afforded an impartial and unsolicited testimony to the standard maintained by Messrs. Newman and Guardia in one important particular, that of shutter speeds. We make these comments before we quote the prices of the cameras we have been reviewing lest the non-informed reader should jump to the conclusion that the sums asked by the makers were out of all proportion to the apparatus. Wood and metal cost little, it is true, but the skilled labour needed in fashioning and adjusting such cameras commands almost its own price in the market.

The weights, measurements, and prices of the two cameras are as follows:—Open back pattern, 2 lb. 14 oz., $6\frac{3}{4}$ x $5\frac{1}{4}$ x $8\frac{1}{4}$ in., price £30; closed back pattern, $4\frac{1}{4}$ lb., $8\frac{3}{4}$ x $5\frac{1}{4}$ x $5\frac{1}{4}$ in., price £32. These figures apply to the only size in which the cameras are made—viz., the quarter-plate—and they include the Zeiss "Protar" lens.

THE "C.X.R." DRAINING STAND.

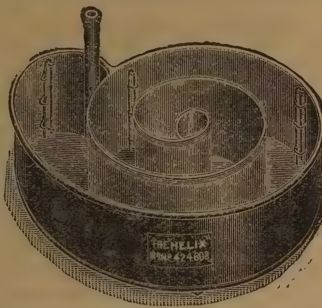
(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

This form of draining stand is made of hard varnished wood, with grooves cut cross-ways to hold the negatives, and lengthways, to allow the drippings to escape. The form of the stand permits any size of negative being held, the weight of the glass only limiting the size which can be placed in it in safety. Each drainer has spaces for 23 plates, and costs 8d.

THE "HELIX" FILM WASHER.

(Sold by Kodak, Limited, 57–61, Clerkenwell Road, London, E.C.)

A very convenient washer for users of roll-film. Its circular partitions provide for the insertion of a 12-exposure roll in two

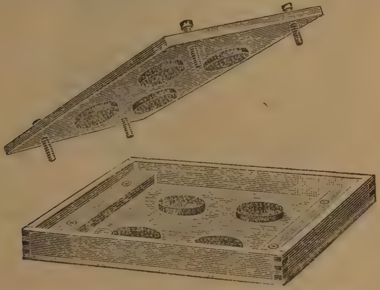


sections, and the inlet and outlet of the water are so arranged as to afford a free passage over the whole surface of the film. If the film is cut up for development each negative is suspended in the water by a clip, and washing takes place in the same manner. The washer is made in about half a dozen sizes, and at prices from 5s. 6d.

THE "HOLBORN" NEGATIVE POSTING BOX.

(Sold by Houghtons, Limited, 88-89, High Holborn, London, W.C.)

A box specially designed to secure safe transit of negatives through the post is supplied by Messrs. Houghton, and ought to be found

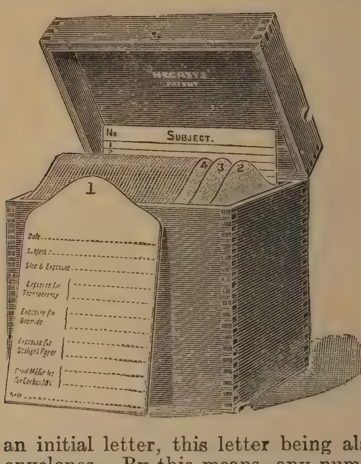


useful by professionals in their dealings with enlargers and printers. The box is provided with felt pads, between which the negative is pressed when the lid is screwed down. As the screws work in brass bushes, the box can be used over and over again. In half-plate size the box costs 1s. 8d.; in quarter-plate, 1s. 4d.

"NEGASYS" AND "PHOSYS" FILES FOR NEGATIVES AND PRINTS.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

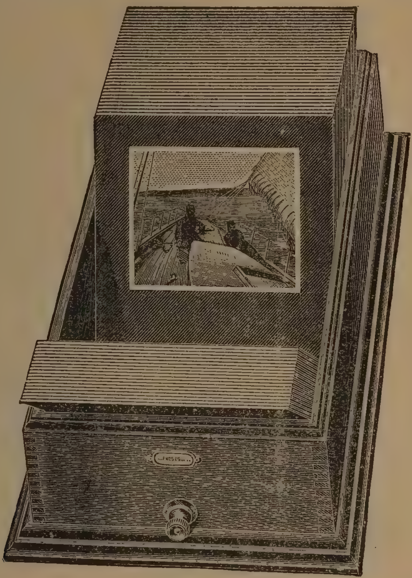
These files are an application of the card-index and vertical filing system. The "Negasys" file is a simple but well-made box, containing fifty numbered envelopes. Each envelope will take a negative, particulars of which can be added outside. An index card completes the file. The principal advantages of this form of filing negatives is that each box will contain as many plates as an ordinary grooved negative box three times the size. The saving in space alone, therefore, is very considerable. In practical use, negatives can be filed by localities, by subjects, by dates, numerically, or in any other way desired, and guide cards can be used to divide or subdivide the negatives. With the aid of the index, any negative can be found and withdrawn without touching any other negative. The "Negasys" files can be either built up in a series of separate units, or the negatives may be treated as a complete series, and



each box given an initial letter, this letter being also added to the numbers on the envelopes. By this means, any number of negatives afterwards replaced without the slightest confusion. When a great can be collected for printing purposes, etc., from various boxes, and number of negatives are filed, a general card index will reduce the system to the greatest possible simplicity. The boxes are made in various sizes, and range in price from 1s. 6d. to 3s. 9d.

The "Phosys" file is intended to replace the album or any other method of displaying prints that has been yet advocated. To the professional photographer, this file should especially appeal. Each picture is plainly visible; each one is mounted separately to suit

its character; all are as secure as in an album, yet each is always interchangeable, and can be taken out and examined as an ordinary mounted print. Each print is mounted on an art paper or card mount. These mounts, which are supplied very cheaply, have a small circular hole cut through them at the bottom, and are stacked together in an oak tray. A metal rod passes through the tray and the cards, and keeps the mounted photographs in position; but this rod can be easily withdrawn, and one or more prints can be taken out for inspection, or the whole number can be turned back like the pages of a book. The applications of this system are limitless, and, used in conjunction with the "Negasys" files, should form a perfect record of both prints and negatives. The oak cases are extremely well made, and in all sizes. In addition to the separate boxes, Messrs. Houghton apply the system in the shape



of handsome boxes and cabinets containing drawers and receptacles for prints of various sizes. These cabinets form ornate pieces of furniture, that will form a pleasing addition to the reception room of any photographer. The quartered oak trays, to take mounts 6 x 6 in. cost 5s., and the prices range from this amount to £5 5s. for cabinets.

(*Continued on page* 875).

BARNET BROMIDE PAPER
SMOOTH PLATINO-MATT.

MISS BILLIE BURKE.

NEG. BY
JOHNSTON & HOFFMANN

THE BRITISH JOURNAL
PHOTOGRAPHIC ALMANAC

AND

Photographer's Daily Companion

FOR

1906.

EDITED BY GEORGE E. BROWN, F.I.C.

For Advertisers' Index, *see pages* 1243–1250.

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PREFACE.

In the present volume the old-established arrangement of the "Almanac" has been revised in so far as seemed necessary to make every part of the text more easy of reference. It is hoped that the contents, which commences on the next page, will enable the reader to put his finger on any given item of information. "Epitome of Progress" occupies a larger share of this year's pages, and has been classified for ease in turning up any formula or process which has appeared in the British and foreign Press during the past twelve months. The references to the original source of each article or communication will, I hope, add to the value of this section of the "Almanac," which it is my intention to maintain and strengthen. Other portions of the volume, it will be seen, have been revised and re-arranged, and I must express my thanks to a number of readers who have been good enough to point out instances where alteration was desirable and have made suggestions of new features.

To the writers whose contributions appear in the earlier pages I must also acknowledge my indebtedness, while I add my regrets that exigencies of space and, in some cases, lateness of arrival have compelled the exclusion of several communications.

It is hoped that the present volume, which, by the way, is larger than any of its predecessors, will be received with the satisfaction accorded in the past, and in ending the task of preparing it for publication I may wish its good friends, and the good friends of The British Journal of Photography everywhere, a happy and prosperous time during 1906.

GEORGE E. BROWN,
Editor.

24, Wellington Street, Strand, London, W.C.

November 1st, 1905.

LONDON: HENRY GREENWOOD & CO.,
Publishers of *The British Journal of Photography*,
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TABLES.

OBITUARY OF THE YEAR.

Among those who have died since the publication of the last "Almanac" may be mentioned :—

Professor Ernst Abbe (January 14, 1905).
Horatio Nelson King (May 25, 1905).
T. C. Hepworth (June 14, 1905).
John Howson (October 3, 1905).
Rev. J. M. Bacon.
E. H. Fitch (July 25, 1905).
C. S. Abbott (March 1, 1905).
Dr. Eugen Englisch.
Ludwig Schrank (May 20, 1905).
G. R. Baker (January 28, 1905).
S. B. Webber (September 17, 1905).

PROFESSOR ERNST ABBE.

Had Professor Abbe lived a few days longer he would have celebrated his 65th birthday, for he was born on January 23, 1840, at Eisenach. His student days were spent at Jena and Göttingen, and he afterwards established himself in the former town as tutor in mathematics, physics, and astronomy. In 1866 he entered into those relations with Carl Zeiss which were to determine the whole course of his career. Twenty years previously Zeiss had founded a small optical workshop in Jena. Microscopes were among his manufactures, and, like other opticians of his day, he designed them by a tentative method of trial and error. But he was convinced that he could base his designs on scientific principles and could work by calculation alone instead of by the laborious processes which were then adopted. He found himself unequal to the theoretical part of that task, but in 1866 he associated himself with Professor Abbe, who, in consequence thereof, turned his scientific work in the direction of the microscope. It was not long before Professor Abbe found that for certain lens combinations he required entirely new descriptions of glass. A report on the state of microscopic optics drawn up by Professor Abbe on the occasion of the exhibition in 1876 of a loan collection of scientific instruments in London, fell into the hands of Dr. Otto Schott, of Witten, in Westphalia. Dr. Schott was a chemist, and established in the glass industry, and in 1881 he commenced at Witten the preparation of glasses which Professor Abbe and his assistant, Dr. Riedel, at Jena, proceeded to subject to optical examination. This first series of tests were on a small experimental scale, and were made to determine the relationship between the chemical composition of a glass and its optical properties. In two years very promising results had been obtained, and the experimental work was then continued on a large scale with the aid of monetary grants from the Prussian Minister of Education. These further researches led, in the

autumn of 1884, to the establishment of a glass factory, the "Glastechnisches Laboratorium Schott und Genossen." Soon after the death of Carl Zeiss Abbe became the sole proprietor of the optical factory, until, in 1891, he resigned all his proprietary rights in the optical works and the glass factory. By this act he created the Carl Zeiss "Stiftung," or trust. The constitution of this "Stiftung," the crown of Professor Abbe's life, provides a complete system of pensions, sick benefits, and profit sharing for all those employed under it. No profits accrue to individuals. The "Stiftung" devotes the surplus which remains after the payment of the above charges to the endowment of Jena University, and the sums which have been granted for this purpose amount, we believe, to more than £100,000. Professor Abbe's salary as director of the optical works could not be more than ten times the wages of a standard workman, and on his retirement, in 1903, he drew the pension provided by the "Stiftung."

Horatio Nelson King.

At the time of his death, Mr. King was 75 years of age. His business, founded in the early days of photography, embraced an immensely wide field of portraiture and landscape, and in the palmy days of the sterescope, and the view-publishing trade, he was one of the largest producers in the market. By permission of the late Queen Victoria, he made a unique collection of photographs of the Royal palaces. On the death of Vernon Heath, he controlled the copyrights of the latter's phenomenally successful series of negatives, including the "Cottage Porch," a subject which was never out of the printing frame for six years, and brought in no less than £6,000. His extensive series of negatives was rarely idle. He introduced photography to the railway companies, and made tours of many parts of the country in the interests of several of the great lines. Mr. King may be named as one of the pioneers in photography for the illustrated press, for his connection with it dates back to 1858, when a photograph of his appeared in the "Illustrated London News." He was early in the field when reproduction fees promised to add to the photographer's income.

T. C. Hepworth.

Mr. Hepworth's vocation of a lecturer and journalist brought his name before all classes of the photographic community. His popularity on the lecture platform was the most distinguishing feature of his professional career. In the Midlands and the North of England his lantern discourses on scientific topics were among *the* fixtures of the season, for he possessed the rare gift of making an intricate subject clear and attractive to the non-scientific hearer. Mr. Hepworth was associated with photography in a number of ways. For some years he was proprietor and editor of "The Photographic News," he was the author of several text-books, and a good many contributions to the photographic Press of recent years came from his anonymous pen.

JOHN HOWSON.

Mr. Howson's name was so well known throughout the photographic trade that it is scarcely necessary for us to refer to his connection first and for many years, with the Ilford Company, and subsequently with the Imperial Dry Plate Company. Under his commercial management—which commenced almost with the inception of the present firm of Ilford, Limited—a series of pioneer steps were taken towards the establishment of popular photography, and, as a corollary, the foundation of plate and paper making as an important industry. The introduction of P.O.P. is, perhaps, associated most intimately in the public mind with Mr. Howson's name, for he spared no energy in familiarising British photographers with the paper, which his Company was the first to place on the market. But in other directions his labours were freely devoted to the important interests of the Ilford business. For several years he was associated in the commercial management of the Imperial Dry Plate Company, Limited.

J. M. BACON.

The Rev. John Mackenzie Bacon was well known to the public as a leading scientific aeronaut, but he came before the photographic public in the capacity of lecturer on aeronautical adventures. His popularity in this sphere was just as great as his reputation among scientific students of meteorology and aerial navigation. Mr. Bacon had many exciting adventures as a balloonist, and his happy narration of them was illustrated by photographs taken by himself. His experiences, other than those contained in his numerous scientific papers and articles, are recorded in two popular works, "By Land and Sky" and "The Dominion of the Air."

E. H. FITCH

Mr. Fitch was associated with the celluloid film manufacture from its early days, and up to the time of his decease was actively engaged in the business. His interest in photography sprang from that of his father, Noel E. Fitch, who was a well-known amateur photographer of the last generation, an active member of the old South London Society, and for some time its treasurer.

C. S. ABBOTT.

Mr. Abbott was President of the American Aristotype Company, Jamestown, New York, and Vice-President of the Eastman Kodak Company. His death took place very suddenly at midnight, Wednesday, March 1, while staying at his country residence in North Carolina.

Dr. Eugen Englisch.

Dr. Eugen Englisch, of the Technical High School, Stuttgart, succumbed to a long illness incurred through his scientific photographic work. He was the author of a well-written text-book, the "Compendium der Praktischen Photographie," and the founder of the "Zeitschrift für Wissentschaftliche Photographie," a monthly journal dealing exclusively with the higher technical and photo-chemical questions.

Ludwig Schrank.

Herr Ludwig Schrank had been before the Continental photographic world for many years, both as editor of the "Korrespondenz" and as Secretary of the Vienna Photographic Society, and at the time of his death he had attained the age of 77 years.

G. R. Baker.

G. R. Baker, for over 30 years with Messrs. J. H. Steward, of 406, Strand, died on January 28, 1904, after a few days illness. Mr. Baker was a constant contributor to the "Journal" and to the "Lantern Supplement," of papers on lantern matters.

S. B. Webber.

The death of Samuel Blatchford Webber, took place at his residence, Bromley, Kent, on Sunday, September 17, at the advanced age of 86. Mr. Webber was a retired goldsmith, and as recently as the Newcastle meeting of the Photographic Convention gave a practical demonstration as to what to do with residues, by making a gold ring out of them and presenting it to the President. He was Vice-President of the Bromley Camera Club, and for many years was one of the trustees of the Photographic Convention, a position which he resigned only a few months since owing to ill-health.

PHOTOGRAPHIC COPYRIGHT.

By the Editor.

INTRODUCTORY.

The law of copyright, as it relates to photography, has continuously figured in the columns of the "British Journal of Photography," from the time when the Act of 1862 conceded to photographers exactly the same rights and privileges as those enjoyed by painters, draughtsmen, and other creators of artistic work. Even those whose association with photography is only of a few years standing, do not need to be told that the intricacies of the Act are a constant source of perplexity, and probably if an analysis were made of the queries addressed week by week to the "British Journal," those on copyright would head the list by an immense majority. Nevertheless, the law of copyright, important as it is to both professional and amateur photographers, has never yet been made the subject of the editorial of the Almanac. In selecting it for a place in the present volume, I am influenced by the facts that no full exposition, in popular language, of photographic copyright exists, and that access to legal treatises devoted to copyright, literary and artistic, in its many ramifications, is not readily attainable. A further inducement to setting down the plain common-sense of copyright law, is that the wording of the Act is so intricate, that even the legally educated are frequently misled by it. Illuminating diction is not to be expected in an Act of Parliament, but Article 1 of the Copyright Act, the kernel of the Act, is as indigestible a piece of writing as one can encounter in the Statute Book. Another important reason for selecting the present as the time to take up the subject, is that the provisions of the Act as formerly construed have been warped to a considerable degree by decisions of the Courts, and a knowledge of these important cases is as necessary to the solution of copyright problems as an understanding of the Act itself. Nevertheless, in applying myself to the task, I have striven to keep as close as can be to the text of the Act, using the decided cases to make clear the meaning of those clauses which have formed the matter of legal

arguments. The full text of the Act, which is "25 & 26 Vict. c. 68," is printed on page 1,067 of the present volume, but in treating of it and in quoting it, as the matter under discussion relates entirely to its provisions in regard to photography, the words applying to other processes of delineation have generally been omitted. By this method it is hoped one of the most frequent causes of perplexity in following its provisions will be removed.

Photography and Fine Art.

¶ 1. In law, photography is classed with painting and drawing, and deductively considered the equal of both, and therefore a fine art. The Copyright Act applies to an "original painting, drawing, and photograph," and grants protection to the results of processes of pictorial delineation, on grounds which have no relation to the eternal question, "Is photography art?" In this respect the British law differs from that of some other countries, where a less degree of protection is obtainable for photographs than for paintings or drawings.

What is Classed as Copyright in the Act?

¶ 2. With regard to photography, the Act defines copyright as :—

> "the sole and exclusive right of copying, engraving, reproducing, and multiplying any photograph and the negative thereof, by any means and of any size."

It is important to note the inclusiveness of the definition. A photograph, is common with a painting or drawing, may not be reproduced by photography or by painting or drawing, or by any means, so that, in the ordinary acceptance, the reproduction is a copy of the original photograph. Any such reproduction constitutes an infringement of copyright. The reproduction may be in a different style and of a different size, but, none the less, it exposes the person committing it to the penalties sanctioned by the Act.

Duration of Copyright.

¶ 3. The Act, with certain provisos, fixes the period of existence of the copyright at "the term of the natural life of the *author* and seven years after his death." Hence it is important to understand how the Act and the Courts define the *author* of a photograph, for the author, and the original proprietor of a copyright, may be two different persons, and although the fact does not often obtain prominence in copyright cases, it should be remembered that the duration of copyright depends solely on the life of its author or creator, and has no connection whatever with the life of the owner, unless they are one and the same person.

The Author.

¶ 4. "The author, being a British subject and resident within

the Dominions of the Crown, of every photograph which has been made either in the British Dominions or elsewhere, or his assigns," is the owner of the copyright according to the Act, except, and the exception is an extremely important one, when

> "the negative of any photograph shall be made or executed for or on behalf of any other person for a good and valuable consideration, the person so executing the same shall not retain the copyright thereof unless it be expressly reserved to him by an agreement in writing, signed by the person for or on whose behalf the same shall be so made or executed, but the copyright shall belong to the person for or on whose behalf the same shall have been made or executed."

In ordinary phraseology, if an individual take a photograph for his own use the copyright is his. If he takes it for some one who pays him for doing so, the person who pays is the owner of the copyright, and if he takes it for his employer, who pays him a salary for his services, the copyright belongs to the employer. In all these cases he is the author, and the duration of the copyright is his lifetime and seven years after his death.

The Photographer as Author.

¶ 5. The question of authorship is, however, not without complications. In most photographic businesses, the production of every photograph is by a division of labour. It may be that half a dozen or more persons are successively employed in the various stages involved in the turning out of a photographic print. The wording of the Act implies that the author can only be one individual, and the decision of the Master of Rolls in the case of "Nottage *v.* Jackson" (1883),* supplies a common-sense, as well as a legal, definition of what is the function of authorship. The author is the person who effectively is as near as he can be the cause of the picture which is produced, that is the person who superintended the arrangement, who has formed the picture by putting the people into position and arranging the place on which the people should be. Thus in a studio or in a business of out-door photographer, it is the operator who arranges the figure or group, or settles the position of the camera and composes the subject, who is the author. An absentee principal is not the author in the eyes of the law, though virtually, by systematised direction of his business, he may have influenced the result so that it might be the same, just as if he performed the work personally. If he be present and superintend the operation, there is the case of "Melville *v.* the Mirror of Life" (1895), as precedent that he is to be considered the author, even though he do not raise a finger in manual labour.

It will be clear from the statement above given of the terms of the Act, or by a reference to the Act itself, that in the ordinary course of the business of a photographer, the photographer does not acquire the copyright in most of his photographs. His business consists in taking photographs for a good and

* "The British Journal of Photography," May 11, July 6, 13, 20, 27, August 10 and 31, 1883.

valuable consideration, or in other words for payment, and in such cases the copyright "shall not belong to him but to the person on whose behalf the same shall be made or executed." That is to say, that, any person who goes to a photographer. and pays, or owes, for the photographs he orders, acquires the copyright in them. Under these circumstances the only way the photographer can reserve the copyright to himself is by an agreement made at the time of sitting, and signed by the person for whom the photographs are taken.

The Sale of the Negative.

¶ 6. If a negative be sold without any written agreement attaching the copyright to either buyer or seller, the copyright is altogether destroyed. To save it it must be assigned in writing to either buyer or seller. The Act is very clear on this point. I quote again from Clause 1, the portion of the proviso ceding the copyright to others than the photographer:—

> "When the negative of any photograph shall be sold or disposed of, the person so selling or disposing of the same shall not retain the copyright thereof, unless it be expressly reserved to him by agreement in writing, signed, at or before the time of such sale or disposition, by the vendee or assignee of such negative of a photograph, but the copyright shall belong to the vendee or assignee of such negative of a photograph, nor shall the vendee or assignee thereof be entitled to any such copyright, unless, at or before the time of such sale or disposition, an agreement in writing, signed by the person so selling or disposing of the same, or by his agent duly authorised, shall have been made to that effect."

It is important to grasp the meaning of this enactment. I am in treaty for the purchase of a business, including a stock of negatives. Most probably the proprietor has no copyright in the majority, but he has a number which *are* his own copyright. Unless he assign the copyright in these to me, and I register the assignments under my own name, the copyrights will not be the property of anybody. The copyrights will be lost. In drawing up the agreement for the transfer of copyrights in the negatives, it is sufficient to append a list of the subjects (each being described sufficiently for identification) and to have the whole document signed by the vendor, transferring the copyrights to the purchaser, or by the purchaser, reserving the copyrights to the vendor, according as the copyrights are or are not to change hands. This transference of a number of copyrights can be made *en bloc*, but the assignments of each must be separately registered, as provided in ¶ 11.

No Copyright in Works of Nature, etc.

¶ 7. Clause 2 of the Act touches a point upon which a good deal of misconception exists. It upholds

> "the right of any person to copy or use any work in which there shall be no copyright, and to represent any scene or object notwithstanding that there may be copyright in some representation of such scene or object."

I photograph Botticelli's "Holy Family" in the Uffizi Gallery, Florence, and the Act gives me the copyright in my copy. But there is nothing to prevent anybody else from making a copy of the original painting. If he copies my copy I have ground for infringement if I can prove that his reproduction was made from my copy. Again, there is nothing to prevent any photographer from planting his tripod in the place occupied by mine in securing some specially pleasing view of a scene, and by other means obtaining a negative, to all intents and purposes, identical with mine. I could cite instances where the choice of a view point identical with that of a published photograph has amounted to robbery pure and simple. But the strict letter of the law gives the opportunity for these sharp practices.

The Photographer's Rights in Using his Photographs.

¶ 8. Can a photographer display or publish prints from negatives he may take of persons or places? It seems hardly necessary to put the question, for the above clause of the Act clearly states that no one has the right to forbid the representation of any scene or object. If there is any restriction, it falls under common law without reference to copyright. A photograph of Alderman Jones, J.P., obtained in the street of Blankton, without his knowledge, is the photographer's to use as he pleases, and Alderman Jones cannot prevent him so long as the display or reproduction of the photograph does not transgress the law of libel, by exposing the subject, for example, to such notice or ridicule as may prejudice his commercial, social, or official position. Similarly I may photograph the residence of Alderman Jones, and he cannot prevent my using the view as a postcard, though he may put forward the existence of the postcard as proof that on a certain occasion I trespassed on his estate. It is questionable if he could make much of such a case, but the general position remains unchallenged, viz., that, so far as copyright is concerned, the photographer has the right to photograph anything "photographable" and to sell or exhibit his copies.

Assignment of Copyright.

¶ 9. Under the Act all copyright is "personal or moveable estate," assignable at law by licence or other written document. The different modes of sub-division of which the "sole copyright" in a photograph is susceptible, do not seem to be appreciated by many photographers. Correspondents to the "Journal" not infrequently ask if reproduction in one issue of a periodical deprives the photographer of further right in a photograph. Of course, it does nothing of the sort, unless a receipt for the usual reproduction fee be innocently signed in which the sole right be ceded to the publishers of the journal,—and there are firms who are not above acquiring illustrations in this way from the ignorant. As a matter of fact, sole copyright can include a good deal. Rights to reproduce in journals are the subjects of special licences which should stipulate that the licence applies to one issue only of the particular journal. Then the right to use that

same photograph may be disposed of to postcard publishers, or others, for reproduction in other forms. It may be sold for window-bill and show-card purposes several times over for use in distinct trades,—none of these sales to prejudice the right of the photographer to sell a further limited assignment to, say, the publishers of art calendars or Christmas cards. As a notable instance of the photographer's rights in respect of the reproduction of a picture in one issue of a paper, there is the case of Guggenheim *v.* Leng & Company.* Mr. Guggenheim, of Wolverhampton, granted Messrs. Leng & Company permission to use a copyright photograph of the Wolverhampton football team in their paper, "Sports." The photograph was issued as a supplement, not in the body of the paper, and a number were also sold separately from the paper. The photograph was also reproduced in Messrs. Leng's paper, "The Week." It was held that though they were within their rights in publishing the photograph as a supplement to "Sports," they had no right to issue it separately, and Mr. Guggenheim obtained judgment for £20, with costs.

Licence for Use of Copyright Photographs.

¶ 10. The following form of licence to reproduce, which is on the lines of the original, issued by the Copyright Union, and is that now adopted by members of the Professional Photographers' Association, may be taken as a model to follow in disposing of limited copyright :—

To Messrs..

of...

In consideration of the sum of......................., receipt hereby acknowledged, you are hereby authorised to reproduce by .... process, in ...., my copyright photograph of .... in the .... the reproduction not to exceed.........inches, my name as the photographer to be printed under each impression, and a proof copy of the reproduction to be supplied immediately on publication. This licence is only for the purpose specified, for one issue only, and the reproductions may not be sold as independent pictures separate from the publication and its accompanying letterpress. This licence is not transferable, and no block or electro of the subject may be sold or disposed of without my written permission.

Dated the......... day of......................, 190....

Signed..............................

....

It will be seen that this only grants the right to reproduce the photograph in one definite publication, in one issue, in one definite process and in or under one definite size, subject, in addition to the money consideration, to (1) the photographer's name being printed under each impression, (2) a copy of the paper being supplied, and (3) it bars all possible use of the right except that for which it was specifically granted. On the other hand, what would be

* "The British Journal of Photography," June 26, 1896, p. 413.

the effect of a permission given in the following form, and many photographers do give permission in similar terms :—

> Received of John Smith the sum of 10s. 6d. for the right to reproduce my photograph of the Nelson Column.
>
> THOS. JONES.

Here, then, is no limitation whatever, and for his own use, at any rate, Smith has acquired the same rights as Jones, the owner of the copyright. It is a legal question whether Smith could not even grant other people permission to reproduce exactly as Jones could. The essence of a licence to reproduce should be that it grants permission for the particular purpose for which it is required, and nothing more.

REGISTRATION.

¶ 11. The fourth clause of the Act appoints the keeping, at Stationers' Hall, of a "Register of Proprietors of Copyright in Paintings, Drawings, and Photographs," in which is entered a statement as to each copyright and subsequent assignments thereof. The last sentence of the clause is almost the most important of the whole Act :—

> "no proprietor of any such copyright shall be entitled to the benefit of the Act until such registration, and no action shall be sustainable nor any penalty recoverable in respect of anything done before registration."

Copyright, be it understood, is created with the photograph and is inherent in it, nor is it forfeited by omission to register, but in the eyes of the law it does not become the photographer's until, by registration, he lays a formal claim to it. The form on which this claim and application for registration are made provides spaces for the following memoranda :—

1. Description of work.
2. Date of agreement.
3. Names of parties to agreement or assignment.
4. Name and place of abode of proprietor of copyright.
5. Name and place of abode of author of work.

In filling up this form for ordinary registration of a photograph, no entries are required in cols. 2 and 3, which are employed only when a copyright is assigned by one person to another. In column 1 the entry should be such as :—"Photograph of Blacktown Rovers Football Team XI., Season 1905-06."

In filling in the name and place of abode of the proprietor, the latter entry may be the business address. In the case of "Nottage *v.* Jackson," already cited, it was ruled that the place of business was to all intents and purposes the place of abode.

In the fourth column the name and address of the person who actually took the photograph must be inserted, whether the person be an assistant or the proprietor himself. The case of "Nottage *v.* Jackson" in the Supreme Court of Judicature, is precedent as to the necessity of correctly stating the author of the photograph. A firm of photographers lost an action for infringement by non-compliance with the Act in this respect.

In the case of assignment of copyright (see ¶ 9), the date of the assignment is inserted in the second column, and the names of buyer and seller entered in column 3.

The authorities at Stationers' Hall will, for 5s., supply a certified copy of the entry of registration, and this document is taken as legal evidence of the claim to proprietorship in the copyright, the ordinary receipt for the 1s. registration fee not being accepted as evidence in a court of law.

To Discover if a Photograph has been Registered.

¶ 12. There is only one way of finding whether the registration of a photograph has taken place, and that is by search at Stationers' Hall. The fee for this privilege is one shilling, and the Hall is open for the purpose from 10 to 4 every week-day, except Saturday, when the hours are 10 to 2.

Which Print to Register.

¶ 13. Occasion may arise when the photographer is in doubt as to the print which should be registered. For example, he wishes to claim the copyright in a worked-up enlargement. Should he register the enlargement or a straight contact print from the negative? Or, he has a P.O.P. print coloured and issued as a three-colour postcard. Which print should be registered, the P.O.P. or the tri-colour? It is probable that in most cases the registration of either print would be sufficient for both, but the rule may be adopted that the more elaborate should be registered as including the simpler print. The Act defines infringement more widely than reproduction in facsimile. Any copy which is a "colourable imitation" of a copyright work is an infringement and therefore so long as the two prints are unmistakably the same representation of the subject, the registration of the more highly finished will suffice for the protection of the cruder photograph.

On the other hand, it may be held that the original print be registered, inasmuch as it represents the negative; and the negative is given equal importance in the Act with the photograph.

Infringement of Copyright.

¶ 14. Clause 6 of the Act specifies the things which constitute infringement of a copyright, and distinguishes between two classes of infringer, viz.:—

(*a*) Those who in knowledge or ignorance of the copyright in a photograph, commit one or other of the acts constituting infringement, and

(*b*) Those, who with knowledge of the unlawful character of copies or imitations of a copyright work, import and distribute the same in the United Kingdom.

In other words, those concerned in the actual infringement are held liable even when they act in ignorance; whereas, a vendor or importer is liable only when he acts with knowledge of the unlawful nature of the copies.

The acts constituting infringement are thus set forth:—No person

"not being the proprietor for the time being, shall repeat, copy, colourably imitate, or otherwise multiply for sale, hire, exhibition, or distribution, or cause or procure to be repeated, copied, colourably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution."

This description of infringement must be read in conjunction with the passage in Clause 1 of the Act—"by any means and of any size. As already mentioned, the copying of a work in any process constitutes infringement. A wash or line drawing, an engraving, and a three-colour reproduction from a photograph are all equally infringements. The reproduction need not be an exact copy of every part of the photograph. The term "colourable imitation" provides against an infringer making such slight alterations to protect himself against the charge of exact copying. An artist may make a drawing from a photograph in his own individual style, but if the whole drawing or certain parts peculiar to the photograph identify the photograph as the original from which the artist worked, the photographer has a claim for infringement. The case of "Bolton *v.* Aldin" (1895)* is interesting in this connection. Mr. Cecil Aldin, the artist, had copied a photograph of a tiger by Mr. Gambier Bolton, the well-known animal photographer. The drawing was ruled to be a "pure copy, and a very good copy" of the photograph, and as additional proof thereof it was shown that the tiger in the photograph had a cancerous growth in the mouth, which had been copied by the artist as part of the mouth itself.

Infringement by Exhibition.

¶ 15. The work of art, says the Act, shall not be repeated, copied, or colourably imitated, for sale, hire, or *exhibition*. The photographer has special reason to note the last word, for it governs the common practice of exhibiting in the window, show-case, or reception-room, prints or enlargements from negatives of his customers. I refer to this point again in ¶ 23, but the law is clear enough. The copyright is the customer's, he having paid a valuable consideration to the photographer, and the latter has no right to use the negative in any other ways than those the customer directs. There are other reasons why this display is forbidden to the photographer, and these I refer to later.

Infringing Part of a Photograph.

¶ 16. Every part of a copyright picture is copyright. The statement may sound axiomatic, but it has been debated. Each portrait in a group is separately the copyright of the person to whom belongs the copyright of the photograph as a whole. Consequently, the reproduction of one face from a group, or one part of a landscape, constitutes infringement. Precedent in the

* "The British Journal of Photography," May 17, 1895, p. 312.

courts for this view is the case of "The London Stereoscopic Company *v.* Kelly, and others," in which the Company moved to restrain the infringement of their rights in a portrait of H.R.H. the Princess of Wales. The infringement consisted of the preparation from the photograph of a crayon drawing of the head, which was put on another body and re-photographed. The Company was granted a perpetual injunction against the infringer.

Copies of Non-Copyright Works.

¶ 17. The case of old paintings and engravings and other works in which there is no copyright, should be mentioned here, because as the Act has been administered, the copies of these works are copyright, although the originals are not. According to the ruling in an old case,* "a photograph taken from a picture is an original photograph, in so far that to copy it is an infringement of this statute," but although it is unlawful to copy the photographic copy of the picture, the owner of the photographic copy cannot prevent the making of other photographic copies of the original picture. A photographer, therefore, must be cautious in copying photographs of paintings, for the reproductions of the work of famous artists are almost invariably the copyright of the publishers.

Ignorance is No Excuse for Infringement.

¶ 18. In speaking of the production of copies or imitations of a copyright work, the Act says nothing about ignorance of copyright condoning infringement. Its silence on this point is ominous, and, unpleasant as the fact may be, the photographer who copies or enlarges a copyright photograph to the order of a customer, or a photo-engraver who makes a block of it, or a printer who multiplies copies of that block, are equally liable with the person who causes any of these things to be done. Take a case in point—that of "Hanfstaengl *v.* Tyler." † Mr. Walter Tyler reproduced, as lantern-slides, a series of coloured pictures, published abroad (chiefly Germany, where registration is unnecessary). He was ignorant of any copyrights subsisting in them, and when the fact of their being copyright in this country (under International Copyright Law) was brought to his notice, offered to deliver up all the slides, undertook not to make more, and to pay a penalty of £12. The offer was rejected, and Mr. Tyler was finally mulcted in damages to the amount of £67.

Copyists of foreign pictures may take it for granted that any having upon them the name of an artist or publisher, are almost certain to be copyright.

In the case of "Baschet *v.* the 'London Illustrated Standard,'" ‡ the liability of a printer is very explicitly put. Five photographs which had been registered in France, were reproduced in the

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* Graves, 1869.
† "The British Journal of Photography," January 25, 1895, p. 50
‡ "The British Journal of Photography," November 17, 1899, p. 726.

"London Illustrated Standard," and it was urged on behalf of the printers that they acted innocently, and as they were the servants of the publishers, were not liable to penalties. But the judge held that the printers were liable under the earlier words of Section 6 of the Act, having, in fact, repeated, or copied, or otherwise multiplied for sale, copies of the plaintiff's copyright photograph without his consent; and, further, he pointed out that this part of the section did not require proof of guilty knowledge, although such proof was necessary before similar penalties could be inflicted upon sellers, importers, or distributors.

Sale of Copies Made Before Registration and Sold Afterwards.

¶ 19. It has been stated that no penalties can be claimed for infringement before registration, and that is an invariable rule; but in the case of copies *made* before registration and *sold* afterwards, the owner of the copyright can obtain, not penalties, but damages, and an injunction restraining the sale of further copies. The action can be taken against anyone selling the copies, whether the actual makers, or the shopkeepers who purchased from them. The precedent for this ruling is the case of "Tuck & Son *v.* Priester."* Messrs. Tuck & Son ordered 2,000 copies of a painting, "Sounding the Charge," of Priester, in Germany, and the latter having printed a number more than were ordered, was afterwards found to be selling these excess copies in England. It was submitted for the defence that the manufacture and importation had taken place before the registration. In the Court of Appeal it was pointed out that Clause 1 of the Act, if it stood alone, would give the photographer a copyright from the moment a picture was made, but Clause 4 provided that a proprietor of such copyright could not sue for breach of copyright until registration had been effected, and even after registration could not recover in respect of anything done before registration. Clause 11 provided that if any person, without the consent of the proprietor, should copy, or procure to be copied, for sale or exhibition, any such copyright work, or sell any such copy, the proprietor, in addition to any penalties, might recover damages, and enforce the delivery to him of all unlawful copies. The question was whether a person might sell, after registration, copies made before registration. The proprietor could not sue in respect of the making of copies before registration. But he could sue for the sale of the copies so made, as copyright existed at the time they were made. The word "unlawful" meant without the consent of the proprietor. Therefore, every proprietor of a work which was pirated before registration could bring an action for a sale or other wrong which was committed after registration. The plaintiff was not entitled to penalties, as, according to Section 6, a penalty might, or might not, be imposed, where a copyright was made, not in this country, but abroad; and the court was bound to take the more lenient reading. Plaintiff was granted damages at £30, and an injunction.

* "Times" Law Reports, 1886-87, pp. 100, 661 and 826.

Penalties, etc., for Infringement.

¶ 20. Under the Act, the recovery possible in respect of infringement of copyright is threefold:—(1) Penalties, including forfeiture of the infringing copies; (2) damages—Section 11; and (3) an injunction.

In regard to penalties, the Act says:—

> "Such person* for every such offence shall forfeit to the proprietor of the copyright for the time being a sum not exceeding £10; and all such repetitions, copies, and imitations, and all negatives of photographs made for the purpose of obtaining such copies shall be forfeited to the proprietor of the copyright."

This wording of the Act was formerly interpreted to mean a coin of the realm for every copy. If the infringement has taken place in a paper with a large circulation, the penalty, even at one farthing—the coin of the lowest denomination—per copy totals up to a considerable sum. Thus, in the case of "Nicholls *v.* Parker and another,† where a Johannesburg photographer recovered penalties for the unauthorised use of a photograph of his in the "Golden Penny," of which 82,000 copies were sold, they were assessed at one farthing per copy, amounting to the substantial sum of £80. These penalties were not allowed by the Court of Appeal, and the custom of a farthing per copy was quashed by the same Court in giving judgment in the case of "Hildesheimer *v.* Faulkner. ‡ A million copies of the infringed picture had been reproduced as cigarette pictures, but the Court of Appeal held that, where reproduced copies of pictures are reproduced without the consent of the proprietor of the copyright, each reproduction is a separate offence, but the court is not bound, in an action for recovery of penalties, to award for each offence the sum of at least one farthing. The only reason for fixing a farthing as the minimum of damages was "because execution cannot be issued for less." But when there was no necessity to issue execution for that sum, there was no necessity for fixing the penalty at a sum which was represented by a coin. The Act fixed only a maximum penalty and not a minimum penalty, and there was no reason why the court should fix a minimum penalty. It may award a sum, which, if divided by the number of offences will give for each offence, something which is not recognised as a coin of the realm.

Recovery of Damages.

¶ 21. Section 11 of the Act confers upon the owner of an infringed copyright the right to recover damages, in addition to any sums obtained as penalties.

He may recover damages by, and in a special action on, the case to be brought against the persons offending, and may in

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* The infringer.
† "The British Journal of Photography." May 17, 1901, p. 312.
‡ The "Times" Law Reports, 1901, p. 737.

such action recover and enforce the delivery to him of all unlawful repetitions, copies, and imitations, and negatives of photographs, or may recover damages for the retention or conversion thereof.

The recovery of damages differs from that of penalties, in that in the case of damages it is incumbent on the party claiming them to prove the damage, whereas penalties are granted on proving the infringement.

How to Proceed in Cases of Infringement.

¶ 22. When a photograph has been unlawfully reproduced, the photographer, before moving in the matter, must first satisfy himself that he is the owner of the copyright. That is to say, that (1) he took the photograph on his own account, without payment; or (2) that the copyright was reserved to him at the time of taking the photograph by agreement in writing; or (3) that the copyright has been assigned to him by agreement. Next, he must remember that "no proprietor of any copyright shall be entitled to the benefit of the Act until registration, and no action shall be sustainable nor any penalty recoverable in respect of anything done before registration." If the copyright has been duly registered before the infringement, and there is no doubt as to who the parties concerned are, the case is a very simple one. Those liable soon find out, as a rule, that it is of no use fighting, and come to terms.

But if the copyright of the photograph has not been registered the owner has legally sustained no wrong by the infringement. He cannot complain of the copying of his photograph, nor of the sale of the reproduction, but directly he registers, he is in a position to take offensive measures against anyone who deals in any way with the infringing reproduction. He has not, however, the same power as if the copyright had been duly registered.* He cannot, for instance, sue for penalties, but his offensive capabilities, if they cannot be so simply put into force, are formidable enough to prevent most infringers from facing a court of law.

It should be remembered that in the majority of cases, an infringement is not a wilful act on the part of the infringer. Very few who have capital to lose would wilfully run the risk of the penalties of an infringement of copyright, for the sake of the small sum for which the right to reproduce might be legitimately acquired. Infringements generally occur through carelessness, or ignorance of the law, or by some misunderstanding, and it is always a safe plan when an infringement is discovered to assume that it occurred through one of these causes, and to treat it as an ordinary business difficulty which requires adjustment. Write, courteously pointing out that your copyright has been infringed, and ask what compensation the offending party is prepared to offer. Confine your first letter to this simple statement and question. On no account ask for any specific sum, for the demand might prevent your recovering penalties, in the event

* See "Tuck and Son *v.* Priester."

of the case coming to a fight, and in claiming damages the sum you ask might be held to be the amount to which you are entitled. Your letter would be evidence of your own estimation of your damages.

In the case of a professional photographer, the wisest course would be to place the matter in the hands of the Professional Photographers' Association at once, and allow their officials to conduct the negotiations. The Association is continually dealing with cases of the kind, and I believe it to be a fact that, so far, every case dealt with has been settled satisfactorily, without recourse to a court of law, and without any law costs whatever.

It should not be assumed that because the law provides drastic punitive means of treating an infringement, it is either right or good policy to avail oneself of it to the utmost. To use the law harshly is extremely bad policy in the interests of photography generally. The law was intended to be protective. It was intended to provide recompense for the deprivation of the fruits of one's achievements, and punishment for those guilty of theft. The wilful infringement of a copyright is theft. It was not intended as a means of extorting an excessive amount when the damage is little and has not been wilfully caused. Too often photographers, when they discover one of their photographs has been infringed, are apt to take the attitude that the wrong done them is extreme, although the right of reproduction would willingly have been granted for an ordinary fee if it had been requested beforehand. In cases where it is clear that the infringement has been unintentional, several of the leading professional photographers are accustomed to accept double the ordinary fee for granting the permission to reproduce, and waiving the right to put the Act into force. On some such lines as these, I believe the Professional Photographers' Association advise their members to compromise the ordinary cases of infringement which are constantly occurring. A photographer who consults the executive body of this Association, or the Copyright Union, before setting the machinery of the law in motion, is not likely to regret having done so.

Photographer and Sitter.

¶ 23. We must now turn to a part of our subject which is not referred to in the Act, but which concerns the professional photographer, in his relations with his sitters, viz., the rights and liabilities of the photographer in respect to the negative. Clause 1 of the Act (¶ 4 above) makes it clear that when a photographer is paid for his services, he receives a "good and valuable consideration," and the copyright is, therefore, not his, but belongs to the person giving the consideration; in other words, his customer. In the case of a group of persons, it belongs to the person making himself responsible for payment. The copyright being the property of the person at whose instance the photograph is taken, he can, if he wishes to, register it, inserting the name and address of the actual operator (not of the proprietor of the business, unless they are one and the same person), in column 5

of the registration form. The owner of the copyright thus obtains rights which the photographer is bound to respect in the use of the negative. But, as photographers know, not one customer in a thousand will register the copyright in his own photograph, and the question arises: Does this fact permit a photographer to print from the negative with impunity? Is he legally within his rights in preparing specimen prints or enlargements, and exhibiting them in his window or reception-room? On other grounds than copyright, the answer of the law is a decisive "No." The case on which later judgments have been based is that of "Pollard *v.* The Photographic Company"* (1889), and is important because judgment was given not on copyright law alone. Mrs. Pollard sat for her portrait in the ordinary way, without special terms or conditions being mentioned between herself and the photographer, the entire transaction being one of the ordinary kind. Subsequently, the portrait was made use of to embellish a Christmas card. *Mrs. Pollard had not registered any copyright in her photographs.* According to the official report of the judge's decision, a photographer who has been employed by a customer to take a portrait is not justified in printing copies of such photograph for his own use, or selling or disposing of them, or publicly exhibiting them by way of advertisement or otherwise, unless the customer has given him "implied" or "express" authority to do so. The contract "implied" by law (there was no "express" contract) which was entered into between the parties when Mrs. Pollard sat to the photographer on this occasion, was that he would not use the negatives for any other purpose than for supplying her with copies. The photographer's property in the negative did not relieve him (in making use of it for his own purpose) from a breach of contract. His Lordship said: "In my opinion, the photographer who uses a negative to produce other copies for his own use, without authority, is abusing the power confidentially placed in his hand merely for supplying the customer; and, further, I hold that the bargain, between the photographer and the customer, includes, by implication, an agreement that the prints taken from the negative are to be appropriated to the use of the customer only." A perpetual injunction was granted against the photographer, who also had to pay the costs of the action.

Surplus Negatives.

¶ 24. In this connection, also, the question may arise: Suppose a photographer takes a sitter in several positions so as to give a choice of pictures, to whom belongs the copyright in those which the sitter rejects.† A police court case* on this point occurred within a couple of years of the passing of the Act. The magistrate then ruled that in the case of two negatives made at a sitting in the ordinary way, payment was the consideration for the labour of the artist, and the consideration for both attempts, and, therefore, the copyright was not vested in the photographer.

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* "The British Journal of Photography," March 29, 1889, p. 215.
† "The Photographic News," October 14, 1864, p. 496.

Legal authorities have declared that such copyright belongs to the person who paid for the portrait, and that the photographer is entitled to the glass only, on which the portrait is impressed. This view is in accordance with the spirit of Clause 1 of the Act, and I beleve it is generally recognised in the profession that any use which the photographer makes of these extra negatives without the express permission of the sitter, exposes him to an injunction and damages, and having obtained the sitter's permission for one purpose, it is illegal for him to use the negative for any other. The surplus negative is exactly on all fours with the negative from which the sitter's order is executed.

What is Valuable Consideration.

¶ 25. The allocation of copyright to the sitter or the photographer being governed by the receipt or non-receipt by the latter of a "valuable consideration," it is necessary to know what has been held to be "good and valuable consideration." If the photographer receives payment for the portrait, that, of course, is valuable consideration. But it has been argued that if he receives no fee, but is granted certain permission by the sitter to sell copies of the photograph, this permission constitutes "valuable consideration." But the judgments do not sustain this view. That of "Ellis *v.* Marshall" ("The Ludgate Monthly")* is decisive the other way.

Photographs Unpaid For.

¶ 26. If a sitter is photographed in the ordinary way of business, and obtains copies without paying for them, to whom does the copyright belong? The question is a most important one, because it applies to cases where the photographer has received no actual consideration, because he cannot obtain payment of his account, and also to instances when sitters retain proofs, decline to pay for them on the ground that they are unsatisfactory, and then have them copied elsewhere. The answer is supplied in the judgment of the Court of Appeal in the case of "Boucas *v.* Cooke." Cooke, a boy preacher, called at Boucas' studio, and arranged for his photograph to be taken, to be used for insertion (as actual prints) in some pamphlets. Boucas was to have the negative, but in the event of a sufficiently large order being given, *e.g.*, several thousand, he would transfer it to Cooke. Certain copies were supplied to Cooke, but owing to a dispute about the price, the arrangement for the quantity fell through. Boucas then registered the copyright in his own name. Afterwards, Cooke arranged with a printer to supply 20,000 half-tone copies, and the printer registered the copyright of his half-tone block of the photograph in his own name. The Court of Appeal pointed out that the question at issue was: Whether the portrait had been taken for, or on behalf of, the sitter for a good and valuable consideration? "Upon that question the evidence was all one way. A person came to the shop and asked to have his photo-

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* "The British Journal of Photography," July 14, 1895, p. 450.
† "The British Journal of Photography," December 12, 26, 1902, p. 994, 1023 and May 15, 1903, p. 392, 403.

graph taken. Obviously, there was an implied promise to pay for it, upon which the photographer could sue the sitter. Obviously, therefore, there was a good and valuable consideration. The evidence showed that the plaintiff, Boucas, always intended to charge for the photograph, and the defendant, Cooke, said he understood he was to pay for it." According to this judgment, it is clear that although nothing may have been actually paid, nor any specific amount agreed to be paid, for the taking of a photograph, if the photographer is in a position to sue for payment for the taking, the copyright does not rest with him.

The Custody of the Negative.

¶ 27. Although the photographer, both under copyright and common law, has no right to use the negative save by the customer's request, yet the customer cannot claim it as his property. This position has been upheld in the county courts over and over again. "Dixon *v.* Ward,"[1] "Andrews *v.* Capper,"[2] "Theobald *v.* Thomas,"[3], and "Harbord *v.* Brewer & Company."[4] But curiously, no case specially raising the question of custody of the negative came before the High Courts until 1903, when a decision of considerable importance was given. The case was "Rotary Photographic Company *v.* Taber Bas-Relief Company."* The Rotary Company, in order to facilitate the execution of an order for a considerable number of prints for the Taber Company, had to make reproductions of the original negatives, and these negatives were separately charged for. Nevertheless, the court held that the negatives so made were the property of the Rotary Company. This decision sets at rest any question which may arise, as to the ownership of the negative taken by a photographer in the ordinary course of his business. The case is practically the same as when an order is given to a letterpress printer. The object of the order, as usually given, in both cases, is to obtain so many impressions. In the one case, the photographer, in order to produce these impressions, has to make a negative; in the other, the printer has to make a forme of type. The delivery of the impressions made, in each case, constitutes the fulfilment of the order, and the possession of the negative or the forme remains with him who made it.

There is a noticeable point about this case of the Rotary Company *v.* the Taber Company, which, as I have said, is the only High Court decision on the subject of the ownership of the negative, and it is this :—The complete report of the case discloses that the production of the negatives in dispute was necessary for the fulfilment of the order. The order was for prints, and the negatives were made of necessity, in the course of producing the prints. It was not an order for negatives and an order for prints from them. The point is a fine one, but no point is too fine for legal disputation, and it should be borne in mind by

[1] [2] [3] [4] "The British Journal of Photography." (1) 1810, p. 372. (2) 1884, p. 202, (3) 1895, p. 114. (4) 1899, p. 792.
* "The British Journal of Photography," March 27, 1903, p. 250.

photographers in making quotations for commercial work (such as machinery and articles for the illustration of price-lists, etc.), that a quotation for the prices of making negatives and for prints is often asked for. A quotation or an invoice for, say, 10s. each for negatives and 1s. 6d. each for prints, might clearly be open to a very different construction legally, from a quotation of 11s. 6d. for taking the photograph and supplying one proof, subsequent prints 1s. 6d. each.

Free Sittings.

¶ 28. The rights of the photographer in regard to the use of the negative are very different when he receives no good or valuable consideration for taking the photograph. Clause 1 of the Act, as we have already seen, then vests the copyright in him. The question of what is valuable consideration has already been mentioned in ¶ 25, in reference to the case of "Ellis *v.* Marshall," which is an instance of the "free" or "invitation" sitting. Miss Mary Moore, the actress, sat for her portrait on the invitation of Mr. Ellis, paying him nothing, though she received a few courtesy copies, and the copyright was ruled to be the property of the photographer. It has been argued that the subsequent sale of copies to the sitter constitutes valuable consideration, but such is evidently not consistent with the Act, which is clear in stating that "the negative shall be made or executed for a good and valuable consideration."

In the very usual case of the reservation of the copyright to the photographer when he receives a consideration, the statute is equally clear in requiring a written agreement at or before the time of sitting. This agreement should state the consideration (reduced price, etc.), which the photographer is to give for allowing him to reserve the copyright, and it should be stamped with a 6d. agreement stamp. A copyright is property, and, legally, a transfer of property involves a consideration. A customer, for a consideration to the photographer, acquires the copyright in his photograph; for a consideration from the photographer, which may be much less than that to the photographer (a discount from the usual price, for instance), he allows the photographer to reserve the copyright; practically he transfers it to the photographer. The following form shows the kind of agreement suitable for the purpose :—

To Mr.......................

....

In consideration of your allowing me a reduction from your usual terms for taking photographs of me or on my behalf, this day, I hereby agree that the copyright in such photographs shall be reserved to you, and that I will not deal in any way with the photographs to prejudice your interest in the copyright.

Dated the.........day of..................., 190....

Signed......................

Witness......................

....

Sittings on Behalf of a Second Party.

¶ 29. When the portrait of a person is taken by the order and at the expense of a second person, the copyright, of course, belongs to the person so giving the order. That follows directly from Clause 1 of the Act, and it has been stated that when a series of portraits is taken at a sitting, ordered in this way, all the portraits are the property of the person ordering the sitting in the absence of any agreement which the sitter and photographer may make at the time for extra portraits.

International Copyright.

¶ 30. Under the International Copyright Act of 1886 rights are obtained by British owners of copyright in a number of foreign countries, these rights being those enjoyed by natives of the country. Similarly, foreigners are granted, in the British dominions, the rights obtainable under British copyright law. By the Berne Convention of 1887, the countries thus agreeing to safeguard literary and artistic copyright form the "Copyright Union." Up to the present time, the following countries have subscribed to the Convention:—

Algiers.	German Empire.	Monaco.
Belgium.	Hayti.	Norway.
Denmark and the Faroe Islands.	Italy.	Spain.
France and its Colonies.	Japan.	Switzerland.
	Liberia.	Tunis.
	Luxembourg.	

One or two countries, notably the United States, do not subscribe to the Berne Convention, and copyright in them is obtainable only through their own laws. International copyright law abounds in intricacies, but the two points which chiefly concern photographers seem to be clearly established, viz.:—

(1.) Compliance with the formalities of the "country of origin" (country where the work was first published) ensures copyright in all the other countries of the Convention.

(2.) The protection thus obtained in these countries, as regards both degree and duration, is that granted the natives of the country, not necessarily that obtained in this country (Great Britain).

Hence, the formalities which foreign photographers must observe to obtain copyright, and the powers granted in foreign countries on registration* here of the copyright, are ascertainable only by studying the copyright laws of these countries, a task which would lead us too far from the chief purpose of this article, which is to compress a statement of the present law of copyright within a small compass. But one or two cases of importance should be mentioned, and for the rest the reader may consult the synoptic

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* Registration is necessary in Great Britain, this being a formality enforced by our copyright law, but registration here is not demanded from owners of copyright in foreign countries subscribing to the Berne Convention. The cases of "Hanfstaengl *v.* Holloway" (1893) and "Hanfstaengl *v.* American Tobacco Co." (1895) uphold this view and overrule the contrary decision in the case of "Fishburn *v.* Hollingshead" (1891).

table (on page 680) of the regulations of the foreign countries in the Convention.

Notable Enactments of Foreign Copyright Law.

¶ 31. Germany and Belgium, among other countries, do not demand registration of the copyright, but in Germany every lawful photographic or mechanical reproduction of an original photograph must bear on the picture or the mounting the name and address of the photographer or publisher, and the year in which such reproduction first appeared. According to the German law, the reproduction of a photograph for use in a work of industry, handicraft, or manufacture, is not piracy. The maker of, say, matchboxes or scent sachets has absolute licence to use any photograph he likes, and so long as his articles of manufacture do not cross the German frontiers, there are no means of stopping his legalised piracy; but if such articles are imported into, or sold in any other country of the Berne Convention, action can be taken. Both he and the persons selling the goods may be proceeded against for damages, and there is also special provision in Clause 10 of the Copyright Act for detaining such goods at the Customs House. The inequity of the German law is particularly marked in the fact of its inclusion of postcards among "articles of industry, handicraft, and manufacture." On this ground the postcard publisher gets his photograph for nothing, but there are signs that this practice cannot be upheld, owing to the fact that large numbers of postcards are occupied entirely by the picture (leaving no space for a message), are never sent through the post at all, and consequently rank not as postcards, but as reproductions pure and simple. Postcards lawfully made in Germany may constitute infringement of copyright on being imported into, and sold in other countries.

French copyright law, in regard to photographs, is confusing, for the reason that a photograph must be first adjudicated a work of art before it is entitled to copyright. From a recent case in the French courts, it would seem that a photographer may be granted protection for his works, not on their separate claims to be works of art, but on his position and reputation as an originator of photographs of artistic qualities.

The Liability of the Seller.

¶ 32. In speaking, in ¶ 14, of infringement, it was pointed out that it may consist of copying and otherwise reproducing, or of importing, selling, or distributing such copies. In the first case, ignorance is no excuse for infringement, but in the second the words of the Act leave the infringer liable only when he acts with knowledge of the unlawful nature of the copies. To quote Clause 6 on this point :—If a person, not the proprietor of the copyright . . . .

"knowing that any such repetition, copy, or other imitation has been unlawfully made, shall import into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause, or procure to be imported, sold, published, let to hire,

distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of the said work or the design thereof,"

then such person is liable to the penalties set forth in ¶ 20.

Although the Act is so specific its administrators appear to have adopted a more severe interpretation of it. So far as the cases prove, it seems as though the seller or inporter cannot offer ignorance as an excuse unless he has taken reasonable steps to inform himself of the facts. In a case* where Messrs. Walker, a firm of hosiers, had distributed as advertisements in their business copies of a copyright picture, "Awakening," the copies had been imported from America through an English agent, and on proceedings being taken against Messrs. Walker, the Sheriff's Court awarded only one farthing damages, deciding that they had acted with every reasonable care. In another case,† "Woolf & Son and Schauer *v.* Wood & Rozelaar," the latter, agents of a New York firm, were proceeded against in the King's Bench Division of the High Court to restrain them from selling a copyright picture of Messrs. Woolf's, which had been reproduced by the New York firm. The action failed on the technical ground that "sale or offer for sale" was not established, but the judge's summing up implies his belief that Messrs. Wood did not know of the existence of the copyright original.

It is not easy to state the precise manner in which the saving clause as to ignorance is interpreted, but the general conclusion is that shopkeepers and other vendors or users of reproductions imported from abroad, and especially from America, should be careful what they sell, for action may be taken against them as well as against the importers.

In conclusion, much more might be said on the intricacies of copyright law, but I believe the above will be found to contain answers to most of the questions with which photographers find themselves confronted. I am indebted to many readers of the "Journal" for suggestions arising out of their own dealings in copyright, and in particular I would acknowledge the kindness of the Executive of the Professional Photographers' Association and its Secretary, Mr. A. Mackie, in placing at my disposal information acquired through the business relations involving copyright, into which the Association has been closely drawn. I am also indebted to Mr. Frank Bishop, President of the Copyright Union, for some suggestions.

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* "The British Journal of Photography," December 25, 1903, p. 1023.
† "The British Journal of Photography," November 6, 1903, p. 889.

COPYRIGHT LAW OF FOREIGN COUNTRIES.

Country.	Duration of Copyright.	Conditions.
Belgium ..	Five years after the death of the author	None .. .. ..
Denmark ..	Five years after the death of the author	All copies must bear the author's name and the words "Exclusive property
German Empire	For five years from the end of the year in which the first copies appeared, or from the making of the negative	Every photographic or photo - mechanical copy must bear, either on the picture or the mounting, the name or firm of the photographer or publisher, his address, and the year in which the reproductions first appeared
Hayti	For life of the author and life of his widow. If he leaves no widow, the copyright passes to his children for twenty years, or to other heirs for ten years	.. ..
Italy	In artistic works, first for the life of the author or forty years, whichever is the longer, then for another forty years, during which time reproduction can be made on payment to the anthor of 5 per cent. of the published price of each copy	.. ..

COPYRIGHT LAW OF FOREIGN COUNTRIES.

Formalities to be Observed.	Notes.
None	.. ..
Declaration must be made at the Department of the Interior and one copy deposited. The declaration must state the full name of the photographer, a description of the photograph, and, if the photograph is reproduced from a work of art, the name of the artist	Actions for infringements can only be brought by an injured party, and within a year and a day. Persons infringing or selling or importing pirated copies are liable to fine and to indemnify the injured person
None	Photographs are granted protection in Germany only when made by Germans. (This applies to photographers resident in Germany, so that an Englishman can obtain protection by registering in England which would not be granted to him were he resident in Germany.)
Five copies to be deposited at the Department of the Interior	.. ..
Three copies must be deposited, with description of same, stating year of publication and desire to reserve rights as author or publisher. The declaration must be made within three months of first publication, but it can be made at any later time within ten years, unless the work is reproduced in the meantime or copies imported from a foreign country	.. ..

Country.	Duration of Copyright.	Conditions.
France* ..	.. ..	.. ..
Japan	For ten years from publication: or taking of negative, if not published	.. ..
Luxembourg..	Fifty years after the death of the author	.. ..
Monaco ..	For the life of the author	.. ..
Norway ..	For five years from the expiration of the year in which the first copy was made, but terminating in any case at the death of the photographer	The word "Einberettiget" (protected) must appear on each copy, also the date of production, the name of the photographer, and the name of the artist if the photograph is a copy of a work of art
Spain	For the life of the author and eighty years after his death	.. ..
Sweden ..	For five years after publication	Each copy must bear the name and address of the photographer and the year of first publication
Switzerland ..	Five years after registration	.. ..
Tunis	For the life of the author, and fifty years after his death	.. ..

* According to Coppinger ("The Law of Copyright," 1904 edition, page 554), copyright in photographs in France has been greatly a matter of controversy, photographs not being expressly dealt with under any legislation. It has been held (*a*) that all photographs are protected under the law of July 19, 1793, by which the copyright in works of art endures for fifty years after the death of the artist; (*b*) that no photographs are protected; (*c*) that

Formalities to be observed.	Notes.
.. ..	.. ..
Registration is made in the Department of the Interior. In default of registration a civil action for infringement cannot be brought, nor can the copyright be mortgaged or transferred	Lawful reproductions of a work of art enjoy copyright as long as the copyright lasts in the original. The right to reproduce photographic portraits belongs to the person who has ordered them
.. ..	.. ..
.. ..	.. ..
Norwegian authorities have notified the Berne International Bureau that no formalities need be observed for the creation or maintenance of copyright or as a preliminary to taking action for infringement, but a law of 1882 demanding registration appears to be still in existence	.. ..
No registration or deposit is necessary in general for works of art	.. ..
.. ..	.. ..
Registration must be made at the Federal Department within three months	.. ..
.. ..	.. ..

only photographs of artistic merit are entitled to protection. The general decisions of the courts seem based on the third alternative. The judges decide whether a photograph is a work of art or not, and their decision can be taken to the highest court of appeal. The French law of 1902 grants copyright to designs of buildings, and an architect can prevent a photograph of a private building being taken for purposes of profit.

CONTRIBUTED ARTICLES.

"AN IMPROMPTU PLATE-WASHER."

By F. Martin Duncan.

The photographer interested in natural history subjects, sooner or later finds it desirable to make a somewhat prolonged stay at some lonely inn or cottage in the very heart of the country, many miles away from any town where he could obtain the use of a dark room. On such an expedition it is often of great importance to know for certain that a good negative of a particular subject has been obtained, and therefore a small developing outfit should always find its place in the photographer's kit-bag. It need take up but little space in the bag, and will be found a great boon. My own outfit consists of a small tin tobacco box, containing one or two bottles of "Tabloid" pyro-soda developer (Factor 6), "Tabloid" hypo, "Tabloid" toning solution, a 2 oz. celluloid measure, and a packet of P.O.P. A folding ruby lamp, a couple of dishes with wooden covers, a printing frame, and a collapsable metal plate rack, such as is used in a plate-washer, complete the outfit.

Now, the greatest difficulty one has to contend with in these out-of-the-way places is not so much the changing of exposed plates, or the developing, but the after washing. The water supply is generally a well or pump, sometimes a spring welling out of the hillside, or a river, and rarely, if ever, convenient or suitable for plate washing. After trying all sorts of dodges, I have found the following method of washing plates the most useful, because the material is nearly always at hand, or can be procured at small cost. This impromptu washing apparatus consists of two old wooden pails or similar receptacles, a box or milking stool, and an old wooden beer tap. At the side, and close to the bottom of one of the pails, I bore a hole and insert the tap. In the bottom of the second pail I bore one, or at most two small holes that will only just permit the water to very slowly run out. The pail with the tap is placed on a stool or box in the garden, in a position where it is not likely to be knocked over by animals or people, and under the tap and just raised off the ground sufficiently to permit the water to flow away from beneath it is placed the second pail containing the metal plate-rack with the negatives to be washed. Water is drawn from the pump or well, and the two buckets filled, the tap of the upper one being turned on just sufficiently to keep the water in the lower pail well over the top of the negatives. To prevent

the water running out too quickly, it is very important that the hole in the bottom of the lower pail is a very small one. Two or three buckets of water allowed to slowly pass through the pails will be found sufficient to eliminate most of the hypo from the negatives, which can then be dried and packed away until the return home, when they should receive a final washing and any after-treatment that may be necessary. By employing the factorial or timing method of development, much more perfect negatives, with good gradation and freedom from fog and stain, will be easily and certainly obtained. Moreover, as factorial development permits of the dish being covered practically throughout the period of development, the plate is protected against the danger of fog from extraneous white light filtering into the room.

BLACK AND WHITE PRINTS ON GASLIGHT PAPERS.

By Major-General J. Waterhouse, I.A.

During my visit to the United States, last year, I saw at the office of the United States Geological Survey a method of quickly reproducing black and white drawings on gaslight papers, which I have since found very useful for copying diagrams, etc.

In the American system the black and white drawing is first reproduced as a paper negative by contact in a pneumatic printing frame, the exposure being made with an electric arc lamp. The print is then developed and washed; from it, if necessary, a positive copy can at once be made, which is developed and fixed in the usual way.

In my own work I have made negatives on "ordinary" or "process" plates, using either the ordinary pyro and soda developer, with a maximum of pyro, or the strong hydroquinone-metol "process" developer given in "Penrose's Note-book," as follows:—

(1)	Metol	40 grs.
	Hydroquinone	50 ,,
	Sodium sulphite	120 ,,
	Potassium bromide	30 ,,
	Water	20 ozs.
(2)	Caustic potash	180 grs
	Water	20 ozs

For use take equal parts of each.

In some cases I found it better to use less of No. 2. This developer works very rapidly, and gives good density and clear lines. I have not found it necessary to intensify these negatives for printing on the gaslight papers, but for photo-mechanical

work it may be desirable to do so. For this I have found the "process" intensifier for dry plates, given in the same work, answer well.—

No. 1.	Mercury bichloride	100 grs.
	Potassium bromide	100 ,,
	Water	10 ozs.

Wash well and rinse with sulphuric acid 2 drachms in 20 ozs. of water; wash and immerse in—

No. 2.	Silver nitrate	100 grs.
	Water	10 ozs.

Add potassium cyanide solution to the silver solution until the white precipitate formed is nearly dissolved. It is essential that a slight precipitate should remain, and the solution should not be filtered. The bleached negative is immersed in this solution till it is blackened evenly through the film. This intensifier is also useful with ordinary negatives.

The gaslight paper is exposed, developed, and fixed in the usual way, and I have found nodifficulty in obtaining black lines on a clean white ground, with suitable exposures in weak daylight.

PLATES FOR HAND-CAMERA STEREOSCOPY.

By Chas. Louis Hett.

The so-called stereoscopic plate, viz., $6\frac{3}{4}$ in. by $3\frac{1}{4}$ in., is quite unsuitable for snapshotting. Its great proportionate length makes it very liable to fracture, and the narrow width gives no margin. Two quarter plates are very much better, and are conveniently handled. In either case the negatives must be cut, or the prints mounted separately. It would be very desirable that the negative should permit of being printed without cutting, and the print mounted in one. This has been done with a single lens and two mirrors in Theodore Brown's transmitter. In the case of a double-lens stereoscopic camera a single mirror would give the desired result. The same effect can be secured by taking the negative through the glass. There are practical objections to either plan, and, on the whole, the balance of advantages appears to be in favour of a plate exposed right up to the ends. A single cut across the centre is then all that is required. The new postcard plate appears to be very suitable, so much so, in fact, that I have commenced making a new camera for the purpose of using them. The lenses will be $2\frac{3}{4}$ in. apart. The plate being cut in halves the two *factory cut* ends will meet in the centre of the print, giving a clean division between the two views.

EXAMINING A SECOND-HAND LENS WHILE AT THE COUNTER.

By Thomas Bolas, F.C.S., F.I.C.

We all—"all," in the hyperbolic sense—know how to test or examine photographic lenses in the laboratory, but there are cases in which a quick decision is desirable, as, for example, when one sees a lens, bearing a reputable name, in a pawnshop window. The reputable name on the mount may give reason enough for going in the shop to examine the lens, but the buyer who purchases a lens merely because of a good name on the mount, is like enough to be bitten—and, to my mind, he deserves it.

The lens bearing the good name may be one of the bold forgeries, of a kind which were common enough thirty years ago, when spurious "Dallmeyers" and "Shepherds" abounded in the pawnshops; or it may be an outcome of the present reprehensible custom of remounting anastigmats in new tubes to suit shutters, and engraving the name of the maker on the new tube—a system exposed in the "British Journal of Photography" some months ago. The remounted anastigmat (genuine glasses and spurious tube) may be good or bad, but the mounting of a high-class lens is a matter of so much delicacy that the chances are against such a composite; but if the genuine tube, released during the fitting of a shutter, is afterwards fitted with glasses and placed on the second-hand market, the chances are, perhaps, still more against excellence; although in one case I purchased a moderately good rectilinear, compounded of a Dallmeyer tube and French glasses.

As regards genuine anastigmats, when offered as second-hand, I do not suggest that all are so damaged as to be worthless, or nearly so; indeed, I have proved the contrary myself, as I have purchased a second-hand anastigmat a year old, and, barring the inevitable slight corrosion of the glass, by exposure, the lens was as good as new. Still, I ought, perhaps, to say that this lens, a parallel to Juvenal's "*Rara avis in terris, nigroque simillima cygno*," was purchased from a careful photographic worker—one worthy to be trusted with a fine anastigmat, the adjustments of which are, in some senses, even more delicate than those of a chronometer.

In purchasing an anastigmat at a counter from a non-expert (as an ordinary pawnbroker), or without the original maker's invoice mentioning the number of the lens, it may be well not to attach the smallest importance or value to the name and description on the mount, excepting as a guide to what one ought to expect and look for in examining the lens itself.

Polish.—The polish of a lens fresh from a high-class maker is a marvel, and something to admire. If one end of the lens is capped, and the other end is looked at while a bright light falls on it, the glass should appear as if almost black. The least appearance of greyness or whiteness of the surface by reflected light indicating a loss of polish, or else surface dirt, but a delicate touch or two with the finger will locally remove

surface dirt. Three month's legitimate use of a lens for snapshotting, or three month's storage in a place alternately damp and dry, may so impair the polish of a lens as to make technically "brilliant" results impossible, to say nothing of the decrease in transparency. A lens which is much dulled by loss of polish is dear at any price, and the same may be said of a lens that has been repolished by a less skilled person than the original maker, as, in this case, the figure will be lost.

Balsam.—An anastigmat in which the cementing material shows the least sign of cloudiness, or starring, or separation, should be looked upon as of quite doubtful value, as the mischief is likely to spread and increase. A lens defective in the above respect, and re-cemented by an unskilled person—or even by an ordinary optical worker of average skill—will generally fail to pass the definition test.

Centring.—View a small spot of light, as a turned-down gas-jet, through the lens, held a distance from the eye, and see if all the secondary images can be made to fall into line on setting the axis of the lens obliquely to the line joining the eye and the gas-jet. If all the elements of the lens are centred, this will be the case. Sometimes a similar test can be made by capping one end, and getting the reflection of some glistening object in the street, but the reflection test will seldom—very seldom—apply to both combinations of an anastigmat. Nevertheless, each combination can often be examined separately by this reflection method, but not the centring of the two combinations in relation to each other. It is this last phase of the centring that is ordinarily disturbed when a central shutter is fitted.

Strain and Cell-Binding.—I know of no shop-counter test for such strain on the glass as does not perceptibly decentre any glass, but the effects of strain will show in the definition test.

Definition and Anastigmatism.—The definition test, as far as examining at a shop counter is concerned, must be by looking at the aerial image—for example, the image of letterpress printing, as an adjacent poster, book, newspaper, or piece of lattice-work. The aerial image should be examined with the aid of a pocket magnifier, held so as to form a telescope, with the photographic objective. The experienced person will see at a glance whether the photographic objective defines well, but, as a rough guide, certain approximate standards may be given. A rapid symmetrical of 6 inches focal length and with an aperture of $f/7$ should define ordinary newspaper print set up at a distance of 8 to 10 feet so well as to enable the letters to be distinguished when a pocket lens of $\frac{1}{2}$ inch or $\frac{1}{3}$ inch focal length is used as an eyepiece but in applying this test the lens should be held as centrally as possible, because the ordinary symmetrical or double aplanat will not define well as far as the oblique rays are concerned. On the other hand, an anastigmat should, with full aperture, define the letterpress well all over its field, or at such extreme obliquity as the mount allows of. The test for anastigmatism (*i.e.*, the absence of astigmatism) is to find some fine cross-like object, and to see if both cross lines are defined

well at numerous points all round the margin of the field, one line of the cross pointing to the centre of the field and the other line being tangential. If, at any point on the margin both the lines of the cross fail to focus sharply at the same time, the lens is not anastigmatic, or it has become so injured generally or locally as to be virtually non-anastigmatic.

Although it is seldom worth while for the ordinary practitioner to buy seriously damaged lenses at any price (and the reader should remember that serious damage may not show itself to the ordinary observer), the experimentalist will find it worth while to buy any damaged or old-style lenses, or part of a lens, provided that only a trifling price is asked, as the combination of the various glasses and parts is a study of never failing interest. Personally, I should seldom, or never, purchase a second-hand lens for real or serious use, but only as a study. and my general advice to others than experimentalists in optics is, "Do not buy second-hand lenses."

WASHING SODA AND PYRO DEVELOPMENT.

By Alfred Watkins.

I have for some years frequently used common washing soda in making up a pyro soda developer in place of the more pure crystals from the chemist's, which latter of course, I still used for test purposes.

Developing by the factorial method, I recently found I was getting greater contrast than the same factor formerly gave, and this coincided with a notice in the "British Journal," that some samples of washing soda consisted largely of sodium sulphate. I then made comparative trials between developers, alike in all respects, except that one was made up with the suspected washing soda and the other with pure sodium carbonate. The result proved that the impurities in the washing soda (probably sodium sulphate), not only acted as a restrainer, but considerably altered the factor at which the developer worked. A plate developed with washing soda for the alkali and a factor of 9 gave the same steepness of gradation as one developed with pure sodium carbonate crystals and a factor of 14.

Moral:—Use the pure crystals.

AN IMPROVED SENSITISING BATH FOR CARBON TISSUE.

By G. T. Harris, F.R.P.S.

I am under the impression that Professor Namias was the first to suggest the use of citrates in the bichromate sensitising bath: but as I have not the facility at the moment of writing for looking up the history of the matter, my statement must be taken

with some reserve. My own conversion to their use was brought about in quite an accidental manner, and for some time I was ignorant of the fact that they had already been used by one or two workers. I had been in the habit of neutralising the plain bichromate bath with .880 ammonia when its colour indicated an undesirable amount of acidity, and on the occasion in question I accidentally added so large a quantity that there was every danger of the tissue being too soluble for safe working if sensitised in it. To avoid the necessity of making up a fresh bath, I proceeded to neutralise the ammonia with citric acid, adding it until the bath lost its smell of free ammonia. This took, by a rough calculation, about 100 grains of citric acid, and the tissue was then sensitised and dried.

I was prepared to find that the large addition of citric acid had considerably modified the tissue in one direction or another, so commenced by exposing a trial piece. This was given the requisite number of tints with a negative of good carbon printing quality, but on development the print was only about a third exposed, although the same exposure with the ordinary bichromate sensitising bath had given fully exposed prints. I at once condemned for future occasions any neutralisation with citric acid, and looked with dismay on the large amount of tissue I had sensitised with the addition. To enable me to use up the tissue I selected some of the thinnest of the negatives wanted in carbon and proceeded to print them, giving three to four times the normal exposure. My first surprise came on developing these, when I found, instead of the flat prints, lacking contrast, usually obtained from these thin negatives, prints of quite perfect quality, vigorous, and full of gradation. At the same time I noticed a distinct improvement in the working of the tissue; stripping took place more readily—a great consideration when using rough-surfaced papers—and the superfluous pigment washed away with much cooler water.

Experiments were afterwards made with regard to the keeping quality of citrate sensitised tissue, which proved indubitably the great value citrates have in this direction. Some tissue was placed in an empty tin, without any especial precautions, such as pressure and rubber bands to exclude air, and after keeping a month it was printed, development taking place readily with water of medium temperature. Tissue sensitised on the ordinary bichromate bath, and stored under similar conditions, would, without doubt, have been quite insoluble at the end of seven days.

To avoid the rule of thumb method of first adding ammonia and then neutralising with citric acid, I made up baths with varying amounts of citrate until I had decided on the most workable proportion. The formula that I have adopted, after considerable experimenting, is as follows:—

Potassium bichromate	2 ozs.
Ammonia (.880)	1 drachm
Sodium citrate	120 grs.
Water	60 ozs.

I have every reason to feel thankful for the accident which led me to discover for myself the value of citrates in carbon printing. Undoubtedly, they confer a great boon by keeping the tissue in a soluble condition for a considerable time without having recourse to storage contrivances that do not always fulfil their mission. From thin negatives prints of undoubted superiority are obtained by the use of citrates in the sensitising bath. The only point that can be urged against their use is the necessity for increased exposure, and this is scarcely noticeable in practical work, as the sensitiveness with citrates added is about equal to platinum paper.

THE CAMERA AT THE PLAY.

By Arthur Payne, F.C.S., F.R.P.S.

The later developments of orthochromatic photography have placed many powers in the hands of professional photographers, the application of which is frequently overlooked. One of the most valuable powers is the provision of various dyes which have been manufactured expressly for photographic use, and may, therefore, be relied upon to give not only constant, but also much improved results upon those hitherto attained. I refer to the use of. such dyes as orthochrome T, pinachrome, pinaverdol, etc. I question if these sensitisers have been used at all by professional photographers, except for the production of trichromatic negatives. The method of using them may be briefly described as follows:—Ordinary dry plates are immersed in a weak solution of the dye used; they are then washed and dried. They attain by this treatment an increase in general sensitiveness, and in addition are made strongly sensitive to the brighter colours, such as orange, yellow, green, and, in some cases, red. The best results are obtained by bathing the plates in the above manner, but the dyes may also be added to the emulsion in the process of manufacture.

Plates prepared in this manner may naturally be used under conditions altogether prohibitive to the use of ordinary dry plates. They answer admirably for all purposes in connection with orthochromatic photography such as the production of colour-correct negatives when used with compensating light-filters, or when used with contrasting light-filters for the purpose of increasing the contrast between two colours in any copy; for instance, they may reproduce yellow as white and blue as black, or red and white may be reproduced in an even tint. I have already referred to their use in the trichromatic process.

But their great value in my opinion, is their sensitiveness to yellow light, which gives the user the power of making rapid

exposures in foggy weather, at sunrise or sunset, or by yellowish artificial light, either in the studio, the home, or at the theatre; and it is this application to photography in the theatre which I will describe, leaving it to the reader to apply the principles under other conditions.

The methods described may be relied upon to give good results, as they are those which I personally use.

An ordinary clean working dry plate of medium sensitiveness is selected (personally, I use Mawson's "Electric" plate), and bathed for three minutes in a bath made up from this formulæ:

Water (distilled)...	400 parts
Ammonia (·880)	6 ,,
Orthochrome T stock solution (1 : 1000) ...	8 ,,

It is necessary to filter this bath before use, and the temperature should be between 60 degrees and 65 degrees F. It is also desirable to carefully dust the plates before immersing them in the bath, which may be contained either in an ordinary porcelain developing dish, or in a grooved porcelain tank. The tank is the more convenient utensil to use when a number of plates are bathed. Care must be exercised to prevent air bells clinging to the surface of the plate. After the plates have been immersed for three minutes in the bath, they are then washed in running water for three minutes and dried in the dark. It is preferable to use a drying cupboard for this work. Many patterns are given in the text books, and that which I use will be found fully described and illustrated in my book on "Orthochromatic Photography."

The keeping qualities of the plates prepared in this manner vary from a variety of causes. It is desirable to use them as soon as possible after they are prepared, though probably they will be found to remain in good condition for a week or ten days.

The dye known as orthrochrome T is manufactured by Meister Lucius and Brüning, Hoechst a/M., and may be obtained through any dealer. It is rather expensive, but a very small quantity will bathe a considerable number of plates. A stock solution is made by dissolving one part of orthochrome T in 1,000 parts of 90 per cent. alcohol, and this solution is stored in the dark, when it is said to keep indefinitely.

The increased sensitiveness to yellowish light conferred upon the plate by this treatment is very great. Taking candlelight as a standard, it was found that whilst the speed of an unbathed "Electric" plate to this light was 106 H. and D., a similar bathed plate possessed a speed of 500 H. and D. It is noteworthy, however, that, within limits, the initial speed of the plate does not affect the final result, for, using a very rapid plate, the "Celeritas," which gives 300 H. and D. to candlelight, it was found to possess the same speed of 500 H. and D. after the process of bathing in orthochrome T. solution.

By using plates prepared in this manner it is quite possible to photograph the scenes in the theatre during the performance, and without any alteration of the ordinary stage lighting, or without the actors and actresses having any knowledge of your presence. The exposure will necessarily vary according to circumstances, but it is quite possible to obtain a good result with one-eighth ($\frac{1}{8}$) of a second at $f/4$. The position of the photographer, the nature of the scene, and the amount of movement upon the stage, are all factors requiring consideration; but it is really surprising what a good result, as regards freedom from movement, may be obtained even with an exposure of two seconds. It is advisable for the photographer to visit a performance, and to select his pictures before taking the camera.

As a guide to the operator in estimating his exposure, I may state that, photographing at a pantomime from the back of the dress circle, I have obtained an excellent result with half a second at $f/8$, the subject being two young ladies singing in an open set scene upon a well-lit stage. It was necessary to give this short exposure on account of the movement of the artistes, but it is always desirable to give the longest possible exposure.

Any who care to enter this field in photography will find it to be, especially to the playgoer, a fascinating, though rather expensive, hobby. It will enable them to obtain many unique and interesting photographs, and it opens up some interesting questions with regard to the law of copyright, into which I am not prepared to enter.

ON EARLY OPTICAL INSTRUMENTS FOR BINOCULAR VISION.

By Dr. Moritz von Rohr (Jena).

There is no doubt that a correct understanding of binocular vision became possible only after Charles Wheatstone's splendid discovery of the stereoscope, but it is equally true, although it sounds paradoxical, that his stereoscope was by no means the first stereoscopic instrument.

Very soon after the discovery of the Dutch (Galilean) telescope, a binocular instrument was formed by a combination of two such tubes. It is proved that the Dutch optician, Johann Lipperhey, of Middelburg, who seems to have been the inventor of the single, succeeded, in 1608, in making the first double telescope. The small field of view of these uncorrected (chromatic) glasses necessitated a rather complicated adjustment for the distance from the object and for the separation of the observer's eyes; these instruments could therefore by no means be used so easily as the opera-glasses now in use. The Capucin friar, Chérubin

d'Orléans, succeeded, between 1670 and 1680, in bringing the mechanical parts of these instruments to greater perfection, and he also constructed the first binocular microscope.

In so far as each object, not of infinite distance, presents two different aspects to the observer's eyes, the binocular telescope is undoubtedly a stereoscopic instrument, and Friar Chérubin—without knowing it—used it for one of the first stereoscopic experiments. These were afterwards (1738) repeated and enlarged by Robert Smith, the Cambridge mathematician, who was well acquainted with Chérubin's double telescope, although he did not approve of the optic performance of its chromatic components.

It is remarkable, that in the latter part of the eighteenth century the double telescopes seem to have fallen into oblivion; I am unable to find any trace of them before 1823. It would be interesting enough if anyone of the readers of the "B.J.A." could give me an instance of an earlier occurrence. Especially the first appearance of an *achromatic* double glass would be very well worth mentioning. Even notices of the period between 1820 and 1840 would not be lacking in interest.

Whereas, in this case, the pictures presented separately to each eye are the virtual images formed by the eye-pieces, Charles Wheatstone was the first to replace them by more or less elaborate drawings in the stereoscope. That was done in 1838, and when in the following year the two photographic processes were published, he was the first to employ them for furnishing stereoscopic pictures. He was aided in his pursuit by some of the best photographers then practising in London—H. Collen and A. F. J. Claudet; but the difficulties were at that time too great for a general application of photography to stereoscopic purposes. Stereoscopic photography had to lie dormant for eleven to twelve years.

SOME HINTS ON FACTORIAL DEVELOPMENT.

By A. Lockett.

It does not seem to be generally known that the calculation necessary in factorial development may be greatly simplified when a developer is used whose Watkins factor is divisible into 60 without a remainder—a requirement fortunately met by the majority of developers in ordinary use. For example, with metol, whose factor is 30, instead of multiplying the time of appearance by 30 and dividing by 60, as usual, the time of appearance may be simply divided by 2 and read as minutes.

The following table may be of use to those who would like to adopt this simplified system of calculation. It will be noticed that it is not applicable to glycin, eikonogen, amidol, or rodinal,

which have factors not divisible into 60 without a remainder. Pyro, having a variable factor, has also not been included. It may or may not be amenable to the above calculation, according to its constitution. The time of appearance, when using this method of reckoning, must, of course, be estimated in seconds.

Developer.	Factor.	Divide time of appearance by
Adurol ... ... / Hydroquinone	5	12
Imogen Sulphite ...	6	10
Kachin ... ... / Pyrocatechin ... / Ortol	10	6 and read as minutes.
Diogen	12	5
Edinol	20	3
Metol	30	2
Diamidophenol ...	60	1

Some workers complain that the factorial system is unsuitable for commercial use, since it involves developing each negative separately; whereas, by the old method, a number of plates can be developed at once in a large dish. This supposition is quite a delusion, for a dozen or more negatives can readily be developed simultaneously by the factorial system, provided only one dish is used, and the developer poured at a sweep over all the plates at once. A card is kept by the operator's side, on which are carefully noted the various times of appearance of the twelve plates, indicating each by a number, according to the place it occupies in the dish. For example, supposing the third plate in the top row first begins to develop after, say, 20 seconds; this would be entered as "No. 3, 20"—and so on, till the times of appearance of all the plates have been noted, when the dish may be covered over, and the total times of the twelve plates quickly calculated on the card. By using the simple system previously described, this is done in a few seconds. Then, with card in hand and keeping a watchful eye on the watch or clock, it only remains to withdraw the developed negatives one by one, as their total times individually expire.

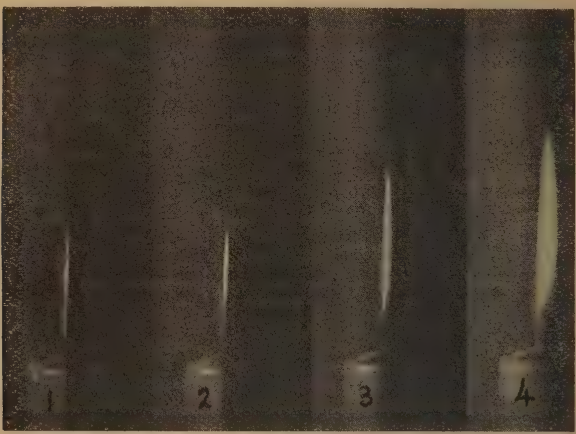
HOW LENSES SEE AROUND CORNERS.

By C. Welborne Piper.

The extent to which a lens can see round a corner is not generally appreciated. The accompanying illustration shows four views (taken with a repeating back) of a candle flame situated behind

the edge of an opaque screen. An 8-inch R.R. lens was used, and No. 1 was taken with $f/64$, No. 2 with $f/32$, No. 3 with $f/16$, and No. 4 with $f/8$. In No. 1 the flame is barely visible, but more and more appears as the aperture increases, until at $f/8$ over half the flame and the whole of the wick is seen. No. 1 should not show any part of the actual flame, but during the long exposure an inopportune draught caused a portion of it to become visible.

The cause of the effect is, of course, a very simple one to understand. As the aperture increases so also does what we may term the viewing station, which is a disc, not a point. The linear



perspective is not affected, for every part of the subject is represented under a correct viewing angle, and just as if it were viewed from one single point. Some portions of the image, however, overlap one another, and while the flame is really behind the screen, it and the screen are both represented together on the same portion of the plate film. Nos. 2 and 3 distinctly show the image of the flame overlapping that of the screen, but the effect is not so apparent in No. 4, owing to the fact that at the large aperture the screen is too much out of focus for its outline to be distinctly traced.

There is nothing unnatural in this effect, though it may appear unusual in the example given. We see under similar conditions even when using only one eye: for, owing to its perpetual rotary movement, the eye sees objects from a virtual viewing station that is much larger than its pupil. The effect is not in any way stereoscopic, and though in particular circumstances it may give an appearance of greater rotundity to a round object, in others

it gives a confused effect, as in the example. Visually, it will frequently be noticed that the image of a very bright object appears to encroach upon that of a nearer and darker object, but the effect is not so readily apparent in photography, excepting when the objects are very near, or the lens is of large diameter. Relatively speaking, the viewing station of a lens of large aperture is very much smaller than that employed in vision, hence the effect is only readily noticeable in particular cases, though it is always existent. It may be observed in views taken through an open doorway. Close observation will reveal the fact that with $f/8$ more of the outside scene is visible than at $f/32$, but though the same conditions will of necessity exist in a view taken out in the open, it will be difficult, if not impossible, to detect any similar effect. This is owing partly to the general confusion of detail, and partly to the fact that the contrast between near and distant objects is not great enough. For obvious photographic reasons the image of a distant dark object cannot be visibly impressed upon that of a near bright object, even though the two images may considerably overlap.

Sir William Abney long ago pointed out that lenses of large diameter gave an appearance of greater rotundity to near solid objects of round form, and, hence, that they were advantageous for portraiture. The effect is, of course, more or less false (though *visually* true), and it may vary considerably with the lighting; also it should not be forgotten that, while it may be of undoubted advantage in portraiture, it may be particularly disadvantageous in other special branches of work.

PAPER.

By Ons.

The subject of paper is one of great importance both to the manufacturer of photographic materials and also to the photographer, but is generally greatly neglected by both. The former should know the impurities in his raw stock, and only by testing systematically can he be certain that he is both receiving material of constant properties and quality, and also that the spots and other defects encountered in manufacturing are not due to the presence of particles of iron or copper embedded in the paper. For a description of physical tests of quality, such as breaking strength, weight per square metre, and thickness, I must refer my readers to any of the well-known manuals on paper-making, notably Cross and Bevan's text-book. With reference to the presence of metallic particles, generally iron or copper, the most satisfactory method is to treat the paper by brushing over with a dilute (1 per cent.) solution of potassium ferrocyanide acidified with hydrochloric acid; the iron will then show up as blue spots,

and the copper as brown. Iron and copper particles are generally in the paper and not in the baryta coating, and are probably detached from the beater knives in the preparation of the paper pulp. Iron may occur in the materials used, such as in the alum or rosin sizing, also in the water used during manufacture, the latter being a common cause of difficulty. Photographic paper should always be, and generally is, composed of linen or cotton fibres, as these forms of pure cellulose alone have no action on silver compounds. Esparto and sulphite wood, carefully prepared, may be satisfactory, but have not yet been tested thoroughly. The presence of mechanical wood pulp is highly undesirable. Should permanency be required, no paper should be used for any photographic purpose which contains any of this material, as this pulp rapidly oxidises in the presence of light and air, becomes converted into a brown substance, and thus rapidly loses its original white colour. Mechanical wood reduces silver salts, and is deeply coloured in developers such as metol, hydroquinone, pyro, etc. The presence of this undesirable substance can be determined by means of an alcoholic solution of phloroglucinol (Wiesner's reagent). This can be procured from Merck's, of Jewry Street, E.C., at a low price, and a small quantity goes a long way. Paper containing mechanical wood, moistened with a drop of this solution, turns a red colour, having a depth corresponding roughly to the proportion of wood. The reaction is accelerated by heating. It is advisable to test any paper intended for gum bichromate or plain salted paper, especially in the latter case. Another source of failure in home sensitised paper, which is also traceable to the raw paper, even when the actual fibres are above suspicion, lies in the gelatine used for sizing. All paper is sized during manufacture with resin, but after the paper is made it is necessary, if the paper is intended for writing or photographic use, to resize the paper on the surface with gelatine or tub-size, as it is technically termed. For photographic raw stock the gelatine used is above suspicion, but there are numerous papers not intended for photography, the surface of which may attract the art photographer, that are probably sized with common glue or gelatine; these should be treated with hot water, and to a few drops of the extract add a drop of silver nitrate. If there is, on warming, any colouration due to precipitate of silver, the paper should not be used for any process involving the use of silver salts, although for gum bichromate they might be suitable. Still, papers of this class are liable to become yellow with age.

HINTS ON SENSITISING P.O.P. POSTCARDS.

By. J. Barker.

With the fashion of printing upon postcards so much in evidence, the following hints and formulæ are offered, as a guide

to those desirous of sensitising their own cards, with the object of enabling them to produce results having either great richness or novel effects both easily and cheaply.

A good average formula for the emulsion being:—

Gelatine (Coignets No. 1.)	40 grs.
Barium chloride	8 ,,
Nitrate of silver	20 ,,
Water	1 oz.
Methyl alcohol	$\frac{1}{4}$ drachm

To make: Procure a yellow glass bottle, pour in the 1 oz. of water, then add the chloride, and next the gelatine; let this soak about half an hour, then warm the bottle to about 95 degrees F. As soon as the gelatine is thoroughly dissolved add the silver all at once, in crystals, shaking gently until dissolved, then add the alcohol, mix thoroughly, let stand about 30 minutes at 95 degrees F., and then coat paper. The above formula can be altered to suit any reasonable conditions. Weakly salted emulsions are preferable for weak negatives, and highly salted ones for rich tones and dense negatives. The quality of the paper used is a large factor in the matter. I have coated this emulsion upon ordinary printing paper, highly glazed surface paper, postcards of various textures; also upon different kinds and colours of blotting-paper, obtaining various effects, some of them being eminently calculated to gladden the heart of an enthusiastic Fuzzyographer. This emulsion will be found to print somewhat slowly, but, if fumed with ammonia, will print much quicker, but will not keep so well. It tones beautifully in the sulphocyanide and gold bath, but for depth and richness of tone the following will be found admirable:—Borax, 5 grs.; acetate of soda, 30 grs.; tungstate of soda, 5 grs.; gold, 2 grs.; water, 8 ozs.

The emulsion can be coated on to either a damp or dry surface, and can be poured on, or the paper may be floated on the emulsion. A good plan for a novice to adopt at first is to pour a small pool of the emulsion on to the centre of the paper, and then distribute it quickly over the surface with a brush. With most surfaces it will be found preferable to have a substratum of some kind—either gelatine, arrowroot, or starch will be found suitable.

A NOTE ON PYRO-SODA DEVELOPERS.

By T. Thorne Baker.

Pyro-soda being, perhaps, the most useful all-round developer we have, every effect that the constituents of a formula produce there is little doubt that the pyrogallol formula containing citric acid and sodium sulphite as preservative, gives the best results,

is worthy of consideration, and in this short note I propose to deal with one or two formulæ giving widely different results, brought about by a difference in the components of the developer.

Many pyro-soda formulæ contain sulphite as the preservative, sometimes acidified, but there is a tendency nowadays to substitute metabisulphite or bisulphite, as its action as a preserving agent (to prevent oxidation of the pyro) is distinctly more powerful. But, in introducing bisulphite there is a danger of "over-doing it," with the result that the developer, whilst working cleanly, gives harsh pictures, and cuts down the effect of the exposure. Thus, in a known instance, a developer containing as much metabisulphite as pyro, showed a plate to be 100 per cent. slower, according to the Chapman-Jones sensitometer, than a similar plate developed with half as much metabisulphite as pyro.

In practice it will be found that from a quarter to half the weight of pyro in metabisulphite is ample, and the more we use, the less rapid will the plates be apparently.

Where the speed of a plate is a matter of importance, such as in focal-plane work, and indoor studio photography, our aim must be to allow the developer all possible energy consistent with cleanliness. The result, needless to say, will be soft, and well-gradated negatives; but fortunately this is precisely what is required in the latter instance while it counteracts the harsh effects of scant exposures in the former. For this kind of work as it yields soft, clean negatives, in which all the available speed of the plate is enabled to do its work.

An excellent formula of this kind may be prepared as follows :—

A.	Pyrogallol	1 oz.	30 gms.
	Citric acid	1 ,,	30 ,,
	Sodium sulphite	5 ozs.	150 ,,
	Water to make	50 ,,	1500 c.c.s.
B.	Sodium carbonate	$12\frac{1}{2}$,,	375 gms.
	Water to make	50 ,,	1500 c.c.s.

Equal parts of these two solutions are taken for use, a little more A. being employed if a vigorous negative be required. No bromide need be used if the full value of exposure is essential, but in every other case a drop of 10 per cent. solution is desirable for each ounce of mixed developer.

Those who are advocates of pyro-metol will do well to make comparative tests with the above formula, which is in all respects its equal.

DARK ROOMS FROM HOME.

By A. L. Henderson.

I wonder why hotel proprietors don't cater more for photographers. They seldom do. When I am abroad I always gravitate to a hotel where I can have a dark room, with a constant

supply of water laid on. When I ask the question: "Have you a photographic dark room?" I get an answer in the affirmative, but on inspection I usually find it a cupboard in the basement or cellar, with no water or sink. Under such circumstances, I have to do the best I can. I get a few empty packing cases (various sizes) placed sideways, the smaller ones on the top of the larger. These serve as benches and shelves. I get a couple of pails, and in the centre of each I put a large wine-bottle full of water. The bottles serve to place the negatives against, and prevent others round the inside from slipping down. I always carry a thick travelling rug, with brass eyelets in the corners; this does to stop out light. Where required, a piece of string, fixed to one of the eyelets and across a nail or pulley at the top, is useful to lift a corner of the rug to allow more light to enter the room. Occasionally I have found well-appointed dark rooms. At Boufarak, in Algiers, I found a hotel with an excellent dark room, doubtless arranged by an expert. At Crieff Hydro they have a well-arranged room, and I took the liberty of pasteing up on the walls (for the guidance of visitors) various formulæ. At Smedley's Matlock Hydro there is an exceedingly well organised large installation. Here is a brief description:—The room is 12 ft. by 9 ft.; at the far narrow end there are three taps, sinks, and lamps (gas), and draining racks; each lamp has a ruby and yellow glass. A curtain separates each sink, so that three persons can work at once. On the left side of the room there are ten lockers, 24 in. by 12 in. by 12 in., with a shelf in each.

I have lately had a trip to Norway. On board the Polytechnic s.s. "Ceylon," the Company advertise "a dark room for photographing," but it is a very small, ill-ventilated place, without accommodation to develop, and dangerous even for changing plates. True, there is a large, fairly-well arranged room, in a most inaccessible part of the ship, which is used by Mr. Smith, the professional photographer who accompanies the ship. If the above remarks should catch the eyes of some hotel proprietors, they may bring forth fruit.

A RETOUCHING WRINKLE.

By Arthur Whiting.

Given a negative of the under-exposed type, or one with broad masses of shadows which need to be strengthened, an efficient method of treating it is to varnish it with matting (not matt) varnish. Rub the latter down with the finger and powdered resin, and then apply a tint of electrotyper's plumbago by means of a stump, tint-stump, or tuft of cotton wool, according to the size of the place to be covered.

In the case of a portrait negative it should be retouched before varnishing, and, if the shadows are very hard, they should also be worked over with the pencil in the usual way.

By this means we are able to soften away the hardness of shadows as much as necessary.

Indeed, care is needed in applying the tint, which must be done evenly and of such a strength as will cause the result to harmonise with the whole. A good formula for matting varnish is :—

Seed lac	2 ozs.
Sandarac	2 ,,
Oil of lavender	½ oz.
Castor oil	1 ,,
Alcohol	40 ozs.

Apply hot, and "bake" well afterwards. Rub down when cold.

A HAND-CAMERA HINT.

By A. Levy.

A good deal of my work is done with a box hand-camera, and as I am long-sighted, I often found it difficult to observe the object in the finder. When I wanted a view, I had to put on spectacles, and frequently it was then too late. Therefore, I designed a small addition to the outfit, which I have found valuable. I fixed a hollow square frame over the finder, the width of the latter. The frame was of thin wood, and on top of it was a small cheap lens. The height of frame to suit the focus of lens was about two inches, and on looking through this I saw the view in finder much larger and very clearly without the aid of my spectacles. The frame, which is very light, is held in place by a small brass spring, and can be adapted easily to either finder on the camera.

I may add a curious fact as to development. I develop my negatives with pyro-ammonia. When a negative is a little too intense, which happens when it is somewhat yellow stained, I expose it to strong sunlight for a few days, when it becomes weaker, or at least the yellow stain disappears.

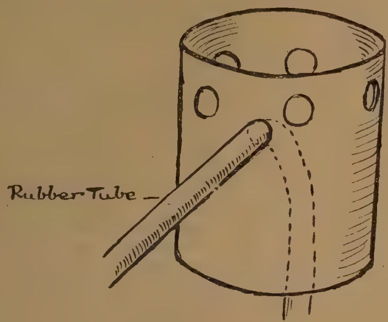
A SYPHON OVERFLOW FOR DARK ROOM SINKS.

By W. W. Topley.

The writer has fitted in his dark room an earthenware sink of the usual scullery type, with fixed grating outlet, and has found the simple arrangement described below possesses all the conveniences of the usual overflow plug, with the additional advantages of enabling a syphon action to be set up when required for

washing, and of rendering the sink while so used available for pouring away waste liquids.

A piece of lead pipe was procured of diameter equal to the grating outlet, and of length equal to the depth of the sink. Round this a number of ½-in. holes were bored close together, with the upper parts distant ½ in. from one end, thus:—



The pipe was placed over the grating (the end with the holes being uppermost), and was luted to make the junction watertight. For this purpose the writer used melted paraffin wax (from an ordinary candle), as enabling the pipe to be easily removed and replaced for cleaning.

A further hole was bored, as shown in the sketch, with its top at the level of the bottom of the other holes; through this was placed a tightly-fitting piece of rubber tubing, and the junction made watertight. The tube was of such length, and so fixed that when in position the lower end rested on the bottom of the sink, and the other passed a short distance through the grating into the waste pipe.

The result is that if a stream of water be allowed to flow into the sink of amount less than the rubber tube can carry away, the water level rises till the lowest hole is reached; the rubber tube being then filled past the bend, the syphon action commences, and continues until the sink is emptied through the difference between the rates of inward and outward flow, and a process of alternately rapidly filling and slowly emptying thus goes on with continual change of the water.

The syphon can be thrown out of action at any time by turning upwards the outer end of the rubber tube; the sink cannot overflow, and even when it is full of water the waste pipe is available.

Thus one can practically have at the same time the use of the sink and of a large syphon washer,

ON GOING IN FOR PROCESS WORK.

By William Gamble.

I am often asked by photographers whether I can recommend them to "go in" for "process" work. One wants to do so on the strength of getting a few local orders for half-tone blocks, another because he has a few postcard blocks made, and thinks the process block makers' charges exorbitant. Others haven't any work at all, but think they could get some. To all such I feel conscientiously bound to advise them not to think about it. There is no money to be made in working the half-tone process on a small scale, and no saving to be effected in making blocks oneself when they can be bought for something less than sixpence per square inch. Photo-engraving has now become a specialised industry, and to turn out good and uniform work quickly and cheaply requires an efficient plant and a staff of workmen. There are men who can do all round work, that is to say, carry through a half-tone block from start to finish, but they are very few, and, generally speaking, the result is not very good, nor does it pay. Suppose such a man is paid £3 per week, he would have to work pretty hard to turn out one or two half-tone blocks completely in a day if they are to be of equal quality to those turned out by the trade houses, and it would take him just as long to make a block 4 by 3 inches as to make one 12 by 10 inches. To begin with, he would be handicapped by not having the electric light, and the day might be dull; the same thing would apply in making the print on to the metal; and when he had got through with the etching and re-etching, he would be beset with difficulties through not having machinery to trim and bevel the plate and mount it in proper style. All the difficulties would be exaggerated through lack of experience, and through things being out of order owing to not being worked regularly and systematically. Again, the small worker could not buy his supplies to advantage in small quantities, and, taken altogether, the game would be found not worth the proverbial candle. If the time spent were reckoned at its fair value, and the cost of materials added, the blocks would cost quite double what a high-priced commercial house would have charged.

Of course, if a photographer wants to make his own blocks for the sheer love of the thing, disregarding time and expense, and having unlimited patience, combined with considerable artistic taste and aptitude for working difficult processes, he can have a most agreeable hobby in working the half-tone process, and it may even be indirectly profitable if he has an outlet for disposing of his results. I will suppose, for instance, that he wishes to get out some local souvenir, and would like to make the blocks himself. He could have the satisfaction of doing it, and although the blocks cost him more than he would be able to buy them for, he could still make a profit on selling the souvenirs.

Similarly, an artist might wish to reproduce his own pictures, just as in the old days many artists were also engravers, when there might be some reason for doing it, and perhaps some publisher would prefer his blocks because of their individual treatment. I have known several artists who have done this, but I have never known one who made it pay.

In such cases, however, I would not recommend going further than the making of the negative, and printing and etching the plate. The finishing and mounting could be put out to be done by a trade house.

An artist would do better to work photogravure than the half-tone process. Here there is scope for his artistic skill : the process is simple, requires very inexpensive plant, and can be carried through single-handed, including the taking of impressions from the plate. These impressions would have a good market value for framing, or to form illustrations for *editions de luxe* if well executed. If the artist is also gifted with the pen he might write round the illustrations an interesting book, and if this was printed and bound in a tasteful style it would command a sale in spite of its price.

The man who simply wants to do process work in order to make picture postcards had better take to collotype, and he can make a cheap beginning by adopting the Sinop process. The principle is exactly the same as the ordinary collotype process, and it leads up to the latter in an easy and simple way. It is quite certain that if he cannot master the Sinop process he will never succeed with commercial collotype. There are some who have taken up the Sinop process who have objected to the trouble of having to sensitise the plates If they do not care for such a little trouble they had better confine their efforts to "press the button" photography, and making their prints on self-toning paper.

That is just the way with the photographer of to-day; he has been so "brought up with the spoon" that he expects to be fed all the time with baby food. Process work is not for him. It is too troublesome. That is why processes of colour photography never seem to become popular. They fascinate the amateur, and he, perhaps, buys the outfits, but he soon puts them on the shelf in hopeless despair.

It needs the sort of man who has experienced the stress of the old wet collodion days tc succeed with photo-mechanical processes, and it is a pleasure to help and advise such earnest workers.

THE SCOTTISH PHOTOGRAPHIC FEDERATION.

By Allan Blair.

There had been for many years a desire for a closer interest and *camaraderie* amongst the various photographic societies in Scotland, and this feeling was given expression in a meeting

convened at Perth, resulting in the formation of the above Federation in 1903. The membership is open to all Scottish photographic societies; each member of a federated society becomes *ipso facto* an Associate of the Federation; unattached photographers residing outside the radius of a photographic society may become Associates, and it is noticeable that already quite a number of these workers have become attached to the Federation.

The aim of the Federation is to "consider and provide means for the mutual benefit, encouragement, and protection of the federated societies, their members, and individual photographers attached to the Federation," and generally for the betterment of photography in Scotland.

The Federation, at its formation, consisted of 16 societies; at the close of the first year it had increased to 23 societies; during 1904 it had further increased to 32 societies; and at the present time it totals 39 societies, besides the non-society photographers who have joined individually as Associates. This growth shows conclusively that the formation of the Federation had, to use a well-worn phrase, met "a felt want"; the fire of combination was ready; it only wanted the spark of the opening meeting to set it in flame. A success such as this was greater than the promotors had hoped for, but fortunately the Council was composed of enthusiasts, who set to work to discharge the trust committed to their charge.

As might be anticipated, in the opening days of the Federation, before the machinery was fully put in motion, meetings were frequent and prolonged, but the Council spared no trouble to get the various departments of the Federation activity in full working order.

In 1903, a list of judges, lecturers and demonstrators, and circulating lectures and lantern slides was published—this was found of great benefit to the societies, who found the introduction into their syllabus of lectures, etc., outside their own immediate circle, introduced new ideas and awakened fresh interest in the society work. This list has been extended and increased each year, and the work done by the gentlemen who contribute to this feature shows that they have the real work of the Federation at heart.

The same year a lantern slide competition was arranged, and to give an incentive to societies to take part in it, Mr. Henry Coates presented "The Henry Coates Challenge Shield"—a beautiful piece of silver work—to be held by the winning society for one year. The competition includes a Society and also an Associate competition. In 1904 268 slides were entered, the Coates Shield being won by Glasgow Eastern Amateur Photographic Association; in 1905 289 slides were forward, when the Paisley Philosophical Institution (Photographic Section) gained the Shield.

The winning slides and a selected few were formed into a circulating set, which went on tour round the federated societies. It is noticeable that since the inauguration of this competition it

has been judged by Messrs. Godfrey Bingley, Ezra Clough, and Alex. Keighley—all prominent figures in the Yorkshire Union—and in the initiatory stages of such a competition, a certain continuity of judges should make for good.

Existing for the betterment of photography in Scotland, the Council, early in its deliberations, came to the decision that the promotion of a great National Exhibition could not fail to stimulate photographic activity, and also give to Scottish photography a certain definite position that it had hitherto lacked. Perth, from its central position, the fact that it had been the birthplace of the Federation, and was the home of its first President, was selected as the venue for the first exhibition of the Scottish National Photographic Salon, as it was decided to call the venture. A radical departure from existing conditions was made when it was agreed that no prizes be given, and that acceptance be the recognition of merit. This decision was viewed with considerable apprehension by the more timorous councillors; it undoubtedly placed the Salon on a high plane, and its success silenced opposition. The exhibition was open to all photographers in Scotland and to Scottish photographers outside Scotland (professional or amateur). The Sandeman Art Gallery was a splendid "housing" for the show, and from the large entry 224 pictures were selected. It is one of the principles of the Salon that each year some prominent worker outwith Scotland be asked to send a representative selection of his work, and Mr. Percy Lewis, Bristol, was the first "foreigner" honoured. The public and the Press hailed the National Exhibition with unstinted praise, and it at one bound jumped into the position of *the* photographic exhibition in Scotland. Here the representative photographic art of the nation was given an entity and cohesion that it hitherto lacked, and southern critics made "discoveries" of photographers of merit of whom they had before been ignorant.

In 1905 The Salon (Scotsmen now speak of the London Salon to distinguish it from the home exhibition which now obtains the definite prefix "the") was held in Glasgow, and was an increased artistic success. Out of 629 frames submitted, 291 were accepted; in addition to these the "foreign" exhibits were representative shows from Mr. Alex. Keighley, of Keighley, and Herr Alfred Enke, of Stuttgart. The position of The Salon was now assured, and practically every Scottish photographer of note was represented on its walls. Unfortunately the large expenses entailed prevented it being a financial success, but this contingency was provided for by guarantors—gentlemen who had the betterment of Scottish photography at heart—so that the funds of the Federation remained unimpaired; this was a rather important matter, as with the small subscriptions payable the Federation is not in a position, as yet, to stand extra expenditure; in fact, the amount of work done on the present subscription is frequently a cause of comment.

In 1906 The Salon will be held in the Albert Galleries, Dundee, and even at this early date (October 16) it promises to quite sustain the reputation gained in previous years. While arrange-

ments are not yet completed, it might be stated that Mr. Evans will represent England, and a specially selected exhibition of German work is being arranged by Mr. Matthies Masuren.

In 1904 "The Blue-Book," the year-book of the Federation, was issued to every Associate. This publication contains, besides rules, list of societies, etc., a list of "experts" ready to advise on photographic difficulties, and a Gazetteer, with list of dark rooms and "reporters." These "reporters" are a valuable innovation, as will be seen from their duties. "The local 'reporters' will send full information about the districts above their names on receiving a request, accompanied by a stamped and addressed envelope." In 1905 this booklet was extended, and again proved popular.

In April, 1904, the first issue of "The Secretary's Letter" was published, and has since been issued monthly to Associates; it contains notes of the doings of the Federation, so that the outlying centres are kept in touch with all that the Council is doing, and thus take an intelligent and active interest in the Federation's work.

In 1904 a print portfolio was also instituted, and from 173 prints submitted, 66 were selected to form the portfolio, which then went on tour round the societies. It is anticipated that even a larger number of prints will be submitted to the current issue.

Such a record of work indicates clearly that the Federation is doing good work for photography in Scotland, and deserves well of all Scottish photographers.

RESIDUES SAVING AND COLLECTING.

By J. H. Smith.

In "The British Journal of Photography" from time to time the question is asked—Are residues worth saving? Opinions differ, some holding that the small amount of silver obtained, and time and trouble involved in collecting and throwing the chlorides and sulphides down, does not pay for doing. From the amateur's point of view this may be so, but from a professional point it certainly does pay, although the percentage of silver obtained from the residues is not so great as in the old wet plate and albumenised paper days, when the waste was much richer in silver, and that article was much dearer. The fixing bath for gelatine dry plates is very rich in bromide of silver, and certainly is worth saving. So also is bromide emulsion paper baths, if a quantity of work is done. I sent some residues from negative fixing baths—a twelve months' saving from a small business—for reduction to a well-known refiner. This was their account for

the same:—5 ozs. 5 dwt. of silver from sulphides at 2s. 3d. per oz., 11s. 9d.; cost of reducing same, 2s.; take also from this amount 1 lb. of sulphide of potassium 1s., postage of residues 4d., leaving a balance of 8s. 5d. to the good. In a large business the amount of silver that may be thrown down the sink would no doubt amount to several pounds during the year. In reference to P.O.P. paper cuttings, I once had a quantity that, when burnt, left in paper ash 28 lbs. I wrote the refiners asking if this would be worth reducing, and they requested me to send ½ lb. for assay, which I did. The answer returned was that it would not pay for recovering. My way of throwing down the silver in residues is this. When a negative fixing bath wants renewing, I take the old one and pour it into a wide-necked glass jar, holding about one gallon, and pour into it a solution of sulphide of potassium (liver of sulphur). If, on testing it the next morning with the sulphide, I still find silver in solution, I add some more, and when clear, filter and collect the same. Baths in which bromide and chloride prints have been fixed can be treated in the same way. In reference to paper cuttings from P.O.P. prints I should place these in a large cask, pour on water, and after well soaking throw them away, leaving the silver to be thrown down with sulphide when the cask is full. In reference to old toning baths of sulphocyanide and gold, the precious metal can be recovered by adding a small quantity of proto-sulphate of iron in solution, first making the bath neutral by adding a little carbonate or washing soda, when the gold will be deposited as a black powder. I have seen it stated in print that the solution must first be made acid before adding the iron, but if this is done the solution will turn a very rich ruby, the gold being still held in solution. To those photographers who have been in the habit of throwing their residues down the sink I would say—Don't. Start saving all your baths containing gold and silver, and you will be amply repaid for the time and trouble taken.

FOCUSSING SCALES.

By J. W. Salisbury.

Focussing by scale can be done as accurately as by the usual method of racking the lens in and out, and when photographing dark interiors the superiority of focussing by scale is unquestionable.

Every camera should be marked with a focussing scale, except hand cameras of fixed focus.

The usual method of marking adopted by the trade is somewhat arbitrary, and the following method is recommended in preference.

Mark for a five-inch lens the following distances:—

12.4 yards $f/5.6$	4.5 yards $f/16$
8.8 yards $f/8$	3.1 yards $f/22.6$
6.3 yards $f/11$	2.3 yards $f/32$

The above scale is such that all objects at half these distances and beyond are in focus.

Let u = the distance of the point focussed on.
u' = the distance of the farthest point in focus.
u'' = the distance of the nearest point in focus.
f = the focus of the lens.

Then taking the permissible disc of confusion at the usual 1/100 part of an inch.

For giving a maximum depth of field we have:—

$u = \frac{100f^2}{x} + f$ where $\frac{f}{x}$ is the stop value according to the usual notation.

The advantages of this method of marking are considerable, as it enables us at once to focus on a point which with the given stop will ensure obtaining a maximum depth of field, and any other distances usually required can be marked as well, where necessary, as in lenses of longer focus. If preferred, the distances can be given in feet instead of yards.

VERBAL PHOTOGRAPHY.

By J. D.

Though the origins and authorships of those words which have been expressly coined for use in the art of photography are mostly known to students, it must be confessed that the average photographer is indifferent as to whence his vocabulary came. One may, indeed, find a trace of this lack of interest even in some text-books, which, whilst informing the reader that some long-forgotten "type" was invented by so-and-so, will probably omit to mention who invented "collodion," or where "photography" was born.

For the inventor of collodion, by the way, one must cross the Atlantic, for it was at Boston, U.S.A., that a young medical student named John Parker Maynard, on March 29, 1848, published the virtues of this solution of gun-cotton as an adhesive plaster in the "Boston Medical and Surgical Journal," and, being especially struck with its stickiness, devised the name "collodion," either directly from the Greek for "glue," or from a Latin term used by the bombastic Paracelsus.

In thus alluding to the classical origin of "collodion," one is reminded that photography is not altogether free from the plague

of nine-jointed neologisms with which scientific Moseses too frequently seek to cajole Nature into surrendering her secrets. Being an offshoot of chemistry, the art has, of course, to adopt chemical terms where necessary, and many of these are fearfully and wonderfully made. There are, too, a sprinkling of optical terms, and a few dozen mostly-forgotten process words. Apart from these, however, photographers have, in the main, been judiciously content with adaptations of the current language. If their "camera" was at one time a chamber a man could put himself in, whereas nowadays it may be so reduced that it can be put inside the man, the evolution of the instrument, *viâ* Leonardo da Vinci and Giambattista della Porta, suffices for explanation; and much the same may be said of the curious devolution of the Latin name for a plant into "lens," or that for a hearth into "focus" But where current English has been deemed incapable of expressing the exact shade of meaning required, the photographer has shown himself equal to the emergency. Mr. G. W. Perry, for example, feeling that "blur" was too ambiguous for his purpose, on November 15, 1859, plumped "halation" into such a gap. The vitality of a word, in fact, bears no relation to its philological faultlessness, else it would be difficult to explain the eagerness with which, a dozen years ago, the man in the street, famishing, perhaps, on the triteness of "hand-camera," seized upon so purely factitious a word as "Kodak"; or how such grotesqueries as "snapshotted" and "snapshottist" found acceptance in spite of the mangling obviously inflicted on the long-suffering English language by their perpetration.

COMPARISONS OF PLATE SPEEDS.

By E. J. Wall, F.R.P.S.

In the Almanac for 1901, pp. 703-706, there appear some notes by Messrs. Hett and Fernau, giving comparative tables of Hurter and Driffield, Watkins, and Wynne's plate speeds. These have been widely quoted, and were no doubt at the time correct; but in the following year Wynne's numbers were raised, so that a revision of the above seems desirable.

Looking carefully through the literature that has appeared on the question of speed determination, I have come to the conclusion that the whole question is in an inextricable muddle, and all that I have been able to do is to "snaffle out the ruck," to use a phrase of Kipling's, one or two simple rules.

To convert Watkins into H. and D.: Multiply Watkins P number by $1\frac{1}{3}$.

To convert H. and D. into Watkins D: Multiply H. and D. by $\frac{3}{4}$.

To convert Wynne into H. and D.: Square Wynne's number and divide by 32.

To convert H. and D. into Wynne: Multiply H. and D. by 32 and take the square root.

To convert Watkins into Wynne: Multiply Watkins by 45 and take the square root.

To convert Wynne into Watkins: Square Wynne and divide by 45.

The following table gives, approximately, the comparative speeds, and may be useful to save calculation:—

H. and D.	Watkins.	Wynne.
500	333	127
475	316	123
450	300	120
425	283	117
400	266	113
375	250	110
350	233	106
325	216	102
300	200	98
275	183	96
250	166	90
225	150	85
200	133	80
175	116	75
150	100	69
125	83	63
100	66	57
80	53	50
60	40	44
40	26	36
20	13	25
10	6	18

The above table and the rules have been worked out on the assumption that the H. and D. standard pyro-soda developer is used, and this has been generally adopted now.

With regard to the action of various developing agents upon speed readings, it is impossible even to summarise all that has been said in the space at my disposal, but the latest, and probably the most reliable, statement on the subject appears in a paper "on the sensitometry of photographic plates," by Messrs. Kenneth Mees & Sheppard ("Phot. Journ.," November, 1904, p. 286), in which they state that "the result of their investigation seems to show that there are two important groups of plates in existence. One group gives the same inertia whatever reducer is employed; the other gives 1.75 the inertia, with ferrous oxalate

that it gives with organic developers. There are a few plates which appear to be intermediate between these groups." It is obviously hopeless, therefore, without examination of all plates and all developers, to give useful data on this point.

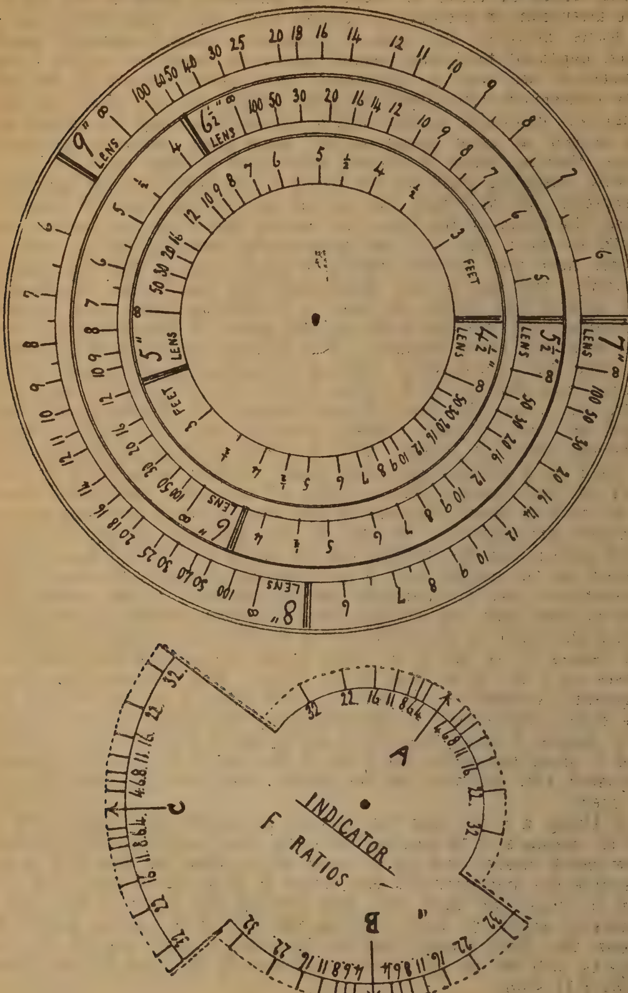
DEPTH OF FIELD.

By J. H. Taylor, M.A., M.B.

To users of stand cameras a knowledge of depths of field is perhaps of little use, as they can see for themselves on the screen what is in good focus. But to users of hand cameras it is often of importance to know for various purposes the depth of field given by their lens with various stops. For instance, we wish to know how much of some view will be in good focus with a certain stop, or what is the largest stop that will give fine detail over the desired area; or, again, we want a slight effusion of focus for some objects, while keeping the principal object sharp, but as we object to excessive fuzziness, we want to know what stop will give the required slight diffusion. Now elaborate tables would be required for each lens in order to get answers to these enquiries. I have, therefore, designed and append a diagram which gives almost at a glance all the information needed for most of the lenses used in hand cameras. Before, however, describing it, it will be well to explain exactly what is meant by the terms "depth of focus" and "depth of field," which are so often misused and imperfectly defined.

In the first place, then, in order to have perfect definition on the screen, there must be a fixed relation between the distance of object from lens and screen from lens; one cannot be altered without altering the other, so that it is impossible with any lens or stop to have two objects at different distances and in the same line in perfect focus on the screen at the same time. For example, suppose a point at 20 ft. from the lens is in perfect focus on the screen when screen is 5 in. from lens; if, now, either the 20 ft. or the 5 in. be altered in the least, the definition suffers; the image of the point is blurred and appears as a disc—the so-called disc of confusion. This is true for all lenses, and the more perfect the lens the more obvious is the blur. So far, then, theory goes. But the human eye is only an imperfect instrument, and if this disc is no larger than 1-100th of an inch, most eyes cannot distinguish it from a point, and as it is generally exposed, 1-100th in. is the allowable disc of confusion. Some persons can distinguish a disc of 1-200th in., and if the negative has to be enlarged it is well to only allow this, but for most purposes 1-100th in. is allowable, and the diagram therefore is based on 1-100th in. as the allowable disc of confusion. Thus it happens in our example that the 20 ft. may be altered to, perhaps, 15 ft. or 30 ft. without a blur of more than 1-100th of an inch, which is inappreciable. If so, then from 15 ft. to 30 ft. is the depth

of field for the lens and stop in use. Again, the screen distance may be altered a fraction of an inch nearer or further from the lens without causing blur of over 1-100th in., and this allowable



alteration is called the depth of definition, or depth of focus. Thus it is seen that the term, depth of field, refers to the allowable alteration in distance of objects from the lens, whilst the terms, depth of focus, or depth of definition, refer to the allowable alteration in distance of screen from lens. The term, depth of focus, however, has been so frequently, though wrongly, used, when depth of field was meant, that it is desirable to give it up entirely if we wish to be exact. At present, however, we are only concerned with depth of field, which we may define as the range of distances within which all objects may be shown on the screen in good focus at the same time, meaning by good focus, that no image is blurred more than 1-100th in.

Now, assuming that we are using a lens corrected for spherical aberration, we find that two factors govern the depth of field :—First, the focus of the lens—the shorter the focus the greater the depth of field, that is, the greater the capacity of the lens to render near and distant objects in good focus at the same time; secondly, the size of the diaphragm—the smaller the diaphragm the greater the depth of field. Combining these two factors mathematically, we can work out the depth of field for every lens and stop and every distance. The diagram appended is intended to save these somewhat tedious calculations, and shows very readily the depths of field for lenses of 4½ in. to 9 in. focus with any stop. In the "British Journal of Photography" for April 28, 1905. I gave a line-diagram for the same purpose, for a different series of lenses. The annexed diagram is intended to be used as a circular revolving depth of field meter, and it consists of two parts :—First, scales of distances for lenses from 4½ in. to 9 in. focus; second, an indicator on which the diaphragm-numbers are marked. To use it, the indicator should be carefully traced and the tracing cut out along the dotted lines; then placed on the scales with a pin passing through the centre dot of each, so that the indicator can be revolved on the scales. It will be seen that the scales consist of three concentric circles, of which the inner is for lenses of 4½ in. to 5 in. focus, the middle for lenses of 5½ in., 6 in., and 6½ in. focus, and the outer for lenses of 7 in., 8 in., and 9 in. focus. The indicator has three segments, marked A, B, and C, and when it is in position on the scales, the arrow A revolves along the scales for 4½ in. and 5 in. lenses, B along the scales for 5½ in., 6 in., and 6½ in. lenses, and C along the scales for 7 in., 8 in., and 9 in. lenses. Having adjusted the indicator on the scales, examples will show how it is used.

1. Using a 6 in. lens for a view in which the chief object is 12 ft. distance, it is required to know how much beyond this and how much nearer will be in good focus when we use *f*/11 stop: Revolve the indicator till the arrow B is at 12 on the scale for a 6 in. lens; we then find that *f*/11 on the right of the arrow points to about 8¼, while *f*/11 on the left of the arrow points to about 22. This means that by focussing sharply on 12 ft., all objects will be in good focus between 8¼ ft. and 22 ft. when using *f*/11 stop.

2. Again, using a 7 in. lens to photograph a group in which the nearest figure is 10 ft. away and the furthest 20 ft., as we wish to reduce exposure as much as possible, we want to know what is the largest stop we may use while getting both extremes in good focus; also, what point must be most sharply focussed. It would not be correct to sharply focus on 15 ft., that is, half way between 10 and 20, because the far depth of field is always greater than the near depth; in other words, sharpness of focus extends much further beyond the point focussed than it does on the near side. If then, we revolve the indicator till the arrow C points to half-way between 10 and 20 on the scale for a 7 in. lens, we shall find it pointing to about 13 ft., which is the point on which we must most sharply focus. We shall also see that 10 ft. and 20 ft. are both included between the two $f/11$ marks, but that $f/8$ does not include 10 ft. and 20 ft., showing that $f/11$ is the largest stop that we may use to get both extremes in good focus.

3. Again, we wish to have a principal figure, which is 20 ft. distant, in perfect focus, but for some bushes only 12 ft. distant we want a slight diffusion of focus, so as not to distract attention from the principal figure. Of course, we must focus sharply on the 20 ft., but what stop must we use of our 6 in. lens? Revolve the indicator until the arrow B points to 20 on the scale for a 6 in. lens; we now find that $f/11$ includes the 12 ft. mark, and so with $f/11$ the bushes will be in too sharp focus. On the other hand, $f/4$ fails by a long way to include the 12 ft. mark, so that with $f/4$ the bushes will be unpleasantly blurred. But the $f/8$ mark only just fails to include the 12 ft., and so by using $f/8$ we shall get the desired slight diffusion of focus for the bushes. It may here be said that in case the lens used is of focus intermediate to any given in the scales, it is sufficient for practical purposes to use the nearest given.

The examples given show the varied ways in which the knowledge of depths of field, as shown by the scales, may be of practical help, either in securing good definition all over a picture or in getting any desired slight diffusion of focus for certain objects in a view.

ADDING NATURAL BACKGROUNDS TO PORTRAIT NEGATIVES.

By J. Tilfor.

Although I consider plain backgrounds preferable to pictorial for portraiture, there are occasions when one of the latter kind is desirable, such as the portrait of a sportsman with his gun, an angler with his rod and tackle, an oarsman in rowing costume, etc. In such cases it rarely happens that an amateur is in possession of suitable painted backgrounds, but probably has many negatives of natural scenery that could be used. The

following method of adding these to the portraits is doubtless well known to the older workers, but may, perhaps, be new to the younger ones.

The portrait should be taken with a plain, dark background. A film negative is then made, either direct from Nature or printed by contact from a transparency. This film, which should be somewhat thinly developed, is attached to the back of the portrait negative, taking care that the lighting is from the same direction. The outline of the figure, together with any foreground objects there may be in the portrait negative, is then traced with a pencil on the film, and that portion carefully cut away. Any little defect caused in doing this can be easily touched out. The thickness of the glass gives just sufficient blurring to prevent the background from appearing obtrusive in the print, and if the work be skillfully done the effect is natural and pleasing.

NATURAL AND IDEAL RETOUCHING.

By A. W. Creighton.

What is natural retouching? It is pencilling on the photographic image so as to preserve the likeness and character of the person represented. Old men are made to look like old men Old women like old women. Children like children, and so on. The principal shadows which give form and expression to the face and features—those from the nose to the mouth, from the mouth to the chin, under and above the eyes, at the side of the nose and under it, above and below the lips, along the cheek, and under the chin; all these shadows are sometimes softened a little, but never removed altogether. What is ideal retouching? It is not exactly natural, but fanciful. An idea, something conceived in the mind, or imagination, the ideality of the mind. Photographers who belong to the ideal school are full of whims and fancies. They always like the portrait negatives of sitters made extra smooth and fine. The most beautiful retouching to them is the very finest kind. They are for ever talking about retouching, and bringing prints to show retouchers, or let them see that their work is either too coarse and rough, or it is not fine enough. It must be done finer, they say. Masters of the ideal school do certainly admit that gentlemen's portraits may have a somewhat broad soft stipple on them. They need not be quite so fine and smooth as ladies' faces, but they like them to come very near it. Ladies' faces must be made as fine and as smooth as possible. All the wrinkles and lines must be taken out of the forehead, except in the case of great age. Masters insist strongly on this—that the perpendicular lines or creases at the top of nose must be entirely removed; also the lines of wrinkles under the eyes like crows' feet—they must be entirely removed. The line from the nose to the mouth must be very much softened, and, if straight, made to take a bi-curve, which

gives a pleasanter expression to the face. Special attention must be given to softening well the lines under the eyes, also, to the mouth and lips. The upper lip is made to take the form of Cupid's bow. The line from the middle of the upper lip to the tip of the nose must be softened and made shorter sometimes. About three lights are sometimes put on the upper lip to improve the expression. The lower lip has often to be made smaller, and at times larger, and rounder in form, which you will observe in good engravings. The lower lip has two or three lights put on it, specially one sparkling high light starting near the corner of the mouth, and going towards the middle of the lip. Observe how it is done in good engravings. You must remove all downward lines from the corners of the mouth, and aim at giving the mouth a perfect form and pleasing expression. The shadow below the lower lip is very much softened and improved. The light on the chin is sometimes brought nearer the lip, so as to give the chin a better shape. The chin is made round and fine in appearance. This is a description of flattering retouching, which is in demand at the present time.

PHOTOGRAPHIC RECORDS.

By George Scamell.

That a considerable amount of interest is now being taken in photographic record work is shown by the number of photographic societies through the kingdom that are making record work a special branch of their programme. The movement was first started at Birmingham, and a society was formed for making a complete photographic survey of Warwickshire. Later, through the energy of Sir J. Benjamin Stone, the National Photographic Record Association was formed, and through its agency some 3,600 prints of interesting buildings or customs have now been collected, uniformly mounted, and stored in the print room of the British Museum for public reference. Any size, from ¼ plate to 10 in. by 8 in. are accepted, provided they are printed by a permanent process. In all record work it is of the greatest value to have some means of judging of the size of the object represented, and for this purpose the Society of Antiquaries publishes a most useful scale, having the yard and metre clearly printed, so that by the introduction of this scale at the same plane as the object photographed, the size can be easily calculated. Failing this, the introduction of a figure will give the approximate size. It also adds very much to the value of the work, if, when photographing a building or any old custom, a complete set can be taken. When photographing an old church, for example, besides external and internal views, what is wanted is a record of any interesting old doorway or bit of sculpture, font, the sedelia and piscinæ, pulpit, and old ornaments, and as an example of a thorough record of an old custom, Sir J. Benjamin Stone's set of the Royal Maund Money distribution may be quoted. It

begins with a number of photographs taken at the Mint when the money was being coined, a set of the money and a purse, the ceremony of distribution, portraits of the Almoner and assistants, and of many of the recipients.

Another important subject is the recording of documents, so that in case of the destruction of the originals, by fire or otherwise, there will be exact copies in existence. The question is being continually asked, what subjects are wanted for record work. The reply is, anything that may be of use or interest to the future historian or scientific man, and everything liable to change. For example, what an immense interest and value would be added to Pepy's Diary if we had an addition illustrated by photographs taken at the time—of the people he met, the houses he visited, the costumes and customs of the time, the ships, coaches, and other means of conveyance, and the thousand little details we now have to guess at. It is sincerely to be wished that the large army of amateur photographers may take up the work seriously, and either let their local museums or libraries have the benefit of their work, or forward copies to the National Photographic Record Association.*

HINTS TO THOSE WHOSE COPYRIGHTS MAY BE INFRINGED.

By E. W. Foxlee.

Being a pretty constant reader of the answers in the Correspondents' Column of the "British Journal of Photography," I notice that a great number of the queries relate to questions of copyright. As one who has paid some attention to the law on that subject, and has been in court when some of the most important cases of infringement have been tried, a few hints may be of use to some of the readers of the Almanac whose copyrights may at some time or other be infringed.

If a photographer takes the precaution to register the copyright in his pictures as soon as they are taken, he has a good cause of action in case of its infringement. He can sue for penalties for every copy made, the maximum being £10 for each. He can also sue for damages, obtain an injunction restraining further issue of the pirated picture, and forfeiture of all negatives, plates, etc. This is all clear enough, but the question is often asked as to how to proceed in the matter, and the answer usually given is to put the case in the hands of a solicitor, with instructions to bring an action against the infringer. That is good advice, particularly if the solicitor employed is well versed in copyright law, which, by the way, the general practitioner often is not. But law is costly, and involves a good deal of anxiety to the litigant, and, in my opinion, it is always well to avoid it if possible.

* The officers and objects of the Association are formally stated on page 619.—Ed. "B.J.A."

Should the copyright be infringed by any respectable magazine or paper, it is often done quite innocently by them, and in this way :—They want, say, a portrait of a certain personage; they write to him for one, and he sends it, perhaps, not knowing that there is a copyright in it that belongs to the photographer who took it. The publishers make use of the portrait, and become liable for the consequences. In such a case as this, if the owner of the copyright writes politely to the publishers, pointing out that he has a copyright in the picture, he will usually find that they are willing to pay a reasonable amount by way of compensation, and it is a question with him whether it will be better to accept that offer than go to law on the chance of obtaining a larger sum. There is an old aphorism about "a bird in hand, etc." Cases have come within my knowledge where in court the plaintiff has not recovered so much as that which was offered before the action was commenced; and, of course, he had to undergo the anxiety and vexations of the law's delays.

There are some photographers who do not think their pictures worth registration until they find they have been copied. Then they at once proceed to register them. This is very like "locking the stable door after the steed has been stolen," for they can recover nothing for what has been done before registration was effected, and they can recover no *penalties* for anything that is done afterwards. All they can do is to sue for damages, and an injunction, but only from the time of registration.

I notice that the editors of the "Journal" sometimes are asked what damages should be claimed in some cases of infringement. One would almost think that the injured party would be better able to assess the damages he may have sustained than one who can know nothing of the circumstances. It should be kept in mind that to obtain damages it must be proved to the satisfaction of the court that some have actually been sustained by the piracy, and that is not always an easy thing to do.

As regards an injunction: if the picture has been copied by, say, a weekly paper, the probability is that the whole of the edition is sold out before the registration is effected, and an injunction obtained. In the case of a picture being copied, as, for instance, for postcards, it may be different; damages may be sued for on the ground that the piracy injures the sale of the original pictures; but they, when awarded, generally amount to very little. An injunction will, however, be useful, as it will prevent the further sale of the piracies.

My advice is not to commence law proceedings before the owner of the copyright has made an attempt to settle the matter with the infringers, particularly if they be innocent, though liable, parties. If a reasonable sum is offered, it will generally be better to accept it than to go to law, for although, perhaps, a somewhat larger amount may be awarded by the court, and the plaintiff may get his costs, he often finds after they have been taxed and he has paid the costs between solicitor and client, he is not so much in pocket as he would have been had he accepted the sum first offered.

EPITOME OF PROGRESS.

In the following pages will be found classified abstracts of papers, communications and articles relating to photography which have appeared in the British and foreign journals during the twelve months, October 31, 1904, to October 31, 1905. In the case of some foreign journals the issues appearing at the close of this "abstract year" may not have arrived in time for inclusion in this year's Almanac, which is made up for press November 1, 1905, but such cases are not numerous.

The scheme of classification, it is hoped, will be understood on reference to the general contents on page 649, and a list of the journals abstracted, with the addresses of the foreign ones, will be found at the end of the "Epitome." In a number of cases where information additional to that given in the abstract has appeared in "The British Journal of Photography," a reference to issue and page has been given.

I.—GENERAL.

EVENTS OF THE YEAR.

NOVEMBER 1, 1904, TO OCTOBER 31, 1905.

December 15.—Seventh Traill Taylor Memorial Lecture, delivered by Dr. R. T. Glazebrook, on "Modern Physics in Relation to Photographic Optics." Abstract in "B.J.," December 30, p. 1112.

January 10.—The Progress Medal for the year 1905 is awarded by the Royal Photographic Society to Dr. Paul Rudolph "for his researches in photographic optics." (An account of Dr. Rudolph's work appears in "B.J.," January 13, 1905, p. 26.)

February 13.—Major-General Waterhouse elected President of the Royal Photographic Society, 1904-5.

April 13.—First meeting of the Professional Photographers' Society of New York. ("B.J.," May 12, 1905, p. 369.)

May 30.—First meeting of the Optical Convention. ("B.J.," June 2, 9, 16, 23, and 30, 1905.)

July 4 to August 12.—Northern Photographic Exhibition at Leeds. ("B.J.," July 7, 1905, p. 531.)

July 10 to 15.—Meeting of the Photographic Convention of the United Kingdom at Dublin, under the Presidency of Professor J. Joly, F.R.S. Reports of the proceedings appear in the "B.J." for July 14 and July 21, 1905. The 1906 meeting of the Convention will be held at Southampton.

July 16, 25.—International Congress of Photography at Liége.

September 15 to October 21.—Thirteenth Annual Exhibition of the Photographic Salon. Owing to the removal of the Dudley Gallery, the Exhibition was this year transferred to the Gallery of the Society of Painters in Water-Colours, 5a, Pall Mall East.

September 21 to October 28.—The Royal Photographic Society's 50th Exhibition. New Gallery.

The Selecting and Hanging Committee (Pictorial Section) was composed of the following gentlemen:—Messrs. W. R. Bland, Furley Lewis, G. A. Storey, A.R.A., W. T. Greatbatch, J. C. S. Mummery, A.R.I.B.A., and B. Gay Wilkinson.

The Judges and Selecting Committee in the Scientific and Technical Section were Messrs. T. Bolas, F.I.C., F.C.S., Douglas English, B.A., T. E. Freshwater, F.R.M.S., Chapman Jones, F.I.C., F.C.S., E. Sanger Shepherd, E. J. Wall, and Major-General J. Waterhouse, I.A.

Medals were not offered in the Pictorial Section, but in the Scientific and Technical Sections the following awards were made:—Medal to Donald H. Hutchinson, M.D., for lantern slides by the Sanger Shepherd process; to John W. Ellis, M.B., for a collection of 60 slides of ecclesiastical architecture; and to Miss Turner, for a photograph of "Great Crested Grebe."

October 24.—Eighth Traill Taylor Memorial Lecture, delivered by Chapman Jones, F.C.S., F.I.C., on "Photography, the Servant of Science."

COPYRIGHT.

Copyright in the Transvaal.—R. C. E. Nissey complains of the copyright legislation in the Transvaal. The formalities are a sworn declaration before a J.P., and attachment of a 2s. 6d. revenue stamp, and of further declaration before a registrar of deeds and payment of 10s., with deposition of three copies of the photograph.—"B. J.," March 3, 1905, p. 178.

Invitation Sittings.—In the Crooke-Shorter case reported in the "B.J.," July 21, 1905, part of the judgment of Lord Ardwall seems to form a precedent. In the case of a photographer receiving sittings from a person at the request of a third party, his lordship said, "he had come without any difficulty to the conclusion that the truth of the matter was the sitting at which the photograph was taken was a sitting for Mr. Shorter, and that he was *prima facie* entitled to all the portraits taken at that sitting, unless it could be shown that Sir Henry Irving and Mr. Shorter agreed to any of the photographs becoming the copyright of the photographer.—B.J., July 21, 1905, p. 561.

BUSINESS.

Photographic Trade in Canada, according to the Secretary of the Canadian Manufacturers' Association, is in the hands of nine firms representing capital of £24,000, and output £46,000. Ninety-six people are said to be employed, and to receive £6,376 annually in wages.—B.J., June 30, 1905, p. 504.

An anonymous writer, accustomed to placing his pictures with the illustrated weeklies, gives the following notes on subjects which have proved profitable. (1). Labourer on excavating gang on the embankment, shown fast asleep. (2) Gutter ragamuffins posed between the paws of the sphinx of Cleopatra's Needle,

(3). Lions in Trafalgar Square being scraped and painted, print entitled "Landseer's lions having a wash and brush up," brought half a guinea. (4) Photographs in girls' academy of physical culture. Pictures of pupils drilling in rational costumes brought several half guineas. Other subjects were: New type of hygienic, artistic dress, old bibles showing misprints, Hall Caine's house and Hall Caine himself, an Elizabethan clock (two half-guineas, one from an American watch-making paper).—Phot., December 5, 1904, p. 11.

Press Photography.—Apparatus, working methods, and dealings with the editors of the illustrated papers are discussed by Thomas Kitto in the "Year Book of Photography," 1905, pp. 263 to 294.

Photographers' Advertising.—A series of articles by W. J. Casey deals with methods of advertising for the professional photographer, and enters into newspaper advertisements, drawing-up "copy," references to the photographer in the Press, window display, railway advertising, circulars, etc.—"B.J.," March 24, p. 224; March 31, p. 246; April 7, p. 264, 1905.

Two further articles by Frank Colebrook contain other hints on this subject.—"B.J.," April 14, p. 286, and April 21, p. 307, 1905.

Some further notes on methods other than through the Press and the usual advertisement channels appear in the "B.J.," June 30, 1905, p. 505.

Ancient Lights.—In a case reported in the "B.J.," February 3, 1905, it transpires that no person, whatever his profession, is entitled to more light than another, although he may enjoy "ancient lights." An architect brought an action against the Bishop of Leeds for light obstructed by the new Roman Catholic Cathedral. The judge decided that a person carrying on a delicate trade was not entitled to a greater enjoyment of light than other persons.

Sulphuric Ether and Collodion for photographic paper are now exempted from custom dues on importation into the Netherlands.—Journ. Soc. Chem. Indus., March 31, 1905, p. 300.

PHOTOGRAPHIC TRADE WITH GERMANY.

A German paper gives the following figures, which do not include British Colonies, of photographic chemicals. "Colour prints and photos" include three-colour prints and photo-mechanical work, and possibly photo-litho:—

	Imported to England in 1903. Kilogs.	1904. Kilogs.	Value. £
Optical Glass	33,300	16,900	20,124
Colour prints and Photos	2,559,100	2,700,900	1,100,621
Optical and Photographic Apparatus	13,000	19 000	46,787
Photographic Paper	572,500	627,500	340,009
Dry Plates	Nil.	Nil.	Nil.
	Imported from England in 1903. Kilogs.	**1904. Kilogs.**	**Value. £**
Optical Glass	Unknown.	Unknown.	
Colour prints and Photos	98,500	142,600	84,850
Optical and Photographic Apparatus	Nil.	Nil.	—
Photographic Paper	33,000	27,700	11,399
Dry Plates	9,000	23,300	Unknown

—"B.J.," February 24, 1905, p. 142.

HISTORY.

The first group ever taken by Daguerre is stated by Mr. Lindsay Johnson to be one of the family of the Marquis de Vivien, whose son gave the Daguerreotype to Mr. Artz. The group is reproduced. "Phot. Journ.," March, 1905, p. 128.

A series of historical notes, entitled "The Week in History," appears each week in the "B.J.," 1905. Each article is devoted to items of progress which celebrate their anniversary during that week.

SOCIETIES.

Women Members of Societies.—A list of the photographic societies in the United Kingdom admitting women as members appears in "Pgm.," May, 1905, p. 141.

Postal Photographic Clubs.—Rules of management, and a directory of the British postal clubs, are given in "Pgm.," February, 1905.

A series of seven articles on "Photographic Societies and Exhibitions," dealing with organisation and management, appears in the "B.J." September 8, 15, 22, 29, October 6, 20, and November 3, 1905.

STANDARD LIGHT.

The Acetylene Standard Light.—M. Monpillard suggests the following modification of M. Ch. Fery's standard acetylene flame, which is a flame burning in air, from a capillary glass tube, the image of the flame being projected by a lens on to a window in an opaque screen, the size of the window being variable—outside this window is placed a plano-convex lens which gives a homogeneous pencil of light. An ordinary steatite burner is used with 0.3 mm. aperture, and burning 5 litres per hour under a pressure of 100-110 mm. of water; this is mounted on a metal tube instead of glass. The flame is surrounded by a metal chimney provided with a diaphragm in its lower part and surmounted by a bent arm. As it is necessary to modify the intensity of the light, which in the original form was equal to 2-10 Carcel, the author points out that the original method of varying the height of the window was not satisfactory, and thus proposes a circular diaphragm, the aperture of which can be varied. —"Bull. Soc. Franc.," March 1, 1905, p. 138.

WEIGHTS AND MEASURES.

"*Mil,*" "*decimil,*" *and* "*centimil*" are the names proposed by the Committee of the Pharmaceutical Society for the thousandth, hundredth, and tenth of a litre, the first-named being an abbrevia. tion for "millilitre."—B.J., December 23, 1904, p. 1081.

II.—APPARATUS AND EQUIPMENT.

Dark Room.

Non-Actinic Paper.—Professor Namias suggests the following mixture for soaking paper for making good non-actinic orange paper :—

Tartrazine (Bayer)	...	96 grains	10 grammes
Rhodamine ...	... ...	10 grains	1 gramme
Water ...	... ...	10 ounces	500 c.c
Alcohol ...	... ...	10 ounces	500 c.c

The amount of rhodamine may be increased at will when a deeper colour will be given; the above, it is stated, is safe for even rapid plates if they are not unduly exposed to it.—"Il Prog. Foto.," April, 1905, p. 67.

A Model Equipment.—The photographic department of the Geological Survey, Washington, is described at length by C. H. Claudy. The department was designed by Norman W. Carkhuff, largely for reproduction work. The moving fronts of the large cameras are controlled from the rear, making a saving of several hours per week, which would otherwise be spent by the operator going to the front of the camera to adjust the position of the lens. The plate-holders, which would need two men to carry them, are suspended on an overhead trolley, running lengthwise and transversely, so they can travel from dark room to camera and back again with little labour. The dark slide enters the dark room through a window which it just fits, and into which it is locked light-tight. The sensitised plate is loaded into the slide, which is then closed and removed to the camera. If necessary, the window can be closed by a shutter, so as to exclude light when the holder has been removed. The trolley system is applied to the electric lights used for illuminating the originals.

When prints have been washed, they are dried in racks, consisting of spring rollers, on which is wound cloth. Through the free end of this cloth, which ends in a turnover, is thrust a stick, Uprights with serrated edges stand the proper distance from these rollers, and the stick is so fitted as to slip into these serrations. By this device an immense number of prints can be dried at once, and in a very small space, and when no prints are being dried, the cloth stretchers are out of the way. The uprights are movable, also, so that this entire space is available for other things when wanted.

Storing Paper.—A large oak case holds the various sizes and varieties of paper. Each separate flat cupboard has a false bottom, which can be readily removed. When a fresh consignment of paper is received, this false bottom is taken out, loaded with the paper, and slid back into place. Any one compartment can be opened without exposing the others, and the paper is absolutely safe in them. By using a scheme of this kind, not

only is a great saving effected in paper, but in the time required to handle it, and in space formerly occupied by the boxes in which the paper is packed. The ventilation scheme comprises electric fans so placed that they do not merely agitate the air, but actually carry it out at the top and draw fresh air in from out-of-doors.—"Sci. Amer.," June 17, 1905, p. 483; "B.J.," June 30, 1905, p. 510.

Repairing Studio Roofs.—Jas. Clark writes:—I got a cabinet-maker to run down each side of the sash beams in the roof cabinet-makers' moulding, first coating the beams and the moulding thickly with white lead. The moulding acts as a gutter under all the top glass, and carries all the water and moisture from the glass out under the eaves. I got the whole job done for some 20s. and am not now at all bothered with leaking roofs.—"B.J.," October 20, 1904, p. 838.

Lenses and Photographic Optics.

GENERAL OPTICS.

Modern Physics in Relation to Photographic Optics.—Dr. R. T. Glazebrook, F.R.S., in delivering the seventh Traill Taylor Memorial Lecture, traces the influence of physical science on the photographic lens. Early in the last century Sir George B. Airy worked out, mathematically, lenses for the camera obscura, discussing, for certain lenses, errors of astigmatism, and curvature of field. These researches were forgotten when photography came into existence. The early English opticians were not mathematicians, and the first complete theory of optical images was given some six years later by Sir W. R. Hamilton. Finsterwalder brought his work into prominence, and Thilssen made it accessible to opticians. After Daguerre's discovery, practical opticians perfected the lens, empirically and by experiment. The advantages of Wollaston's meniscus were appreciated at once. Petzval, of Vienna, alone in applying elaborate calculations to the form of a lens, produced the Petzval combination, and published his theory in 1840. Progress was slow until 1870, when Abbe and Schott commenced their researches into optical glass. In 1856, Von Siedel worked out the theoretical form and material of a lens, and about the same time as Petzval showed where the real difficulty in future progress lay. Glass was to be made with certain definite properties; the work was no longer empirical. In 1880, Dr. von Siedel gave a general exposition of the theory of aberrations, and his paper was published in 1898 by the Bavarian Academy of Sciences. A clear idea of Von Siedel's work is given by Professor S. P. Thompson, in the fourth Traill Taylor lecture ("B.J.," Almanac, 1903, p. 787), and in the translation of Lummer's "Photographic Optics." The result of his work is to express the difference between the position of the point where any two rays intersect and the point where they would intersect if the Gauss theory were true, and he finds the difference expressed as the sum of a series of terms, $S_1 + S_2 + S_3 + S_4 + S_5$. These terms

involve the focal lengths of the lenses, their curvatures and refractive indices, and the distances between them. Each term in the Von Siedel series has a distinct physical meaning. The optician knows that by satisfying a certain definite relation between the form, position, and refractive indices of his lens he can reduce each aberration in turn to a minimum. Given the constant of his system, the designers can predict in general terms what its performance must be.

Could all the conditions be satisfied, even with a number of lenses? It was known by Petzval and Von Siedel that it was impossible to satisfy both the achromatic condition and that for flatness of field. Abbe and Schott developed the art of making optical glass, and enabled practical steps to be taken to give the photographer a perfect lens.

The lecture concludes with a description of lens-testing apparatus as used at the National Physical Laboratory.—"Phot. Journ.," January-February, 1905, p. 43; "B.J.," December 30, 1905, p. 1112.

Photographic Optics.—A series of chapters appears in the "Optician," from November 4 to 25, 1905. It describes the construction of the chief modern lenses.

On the Curvature Method of Teaching Optics.—C. V. Drysdale, D.Sc., "Phil. Mag.," April, 1905, p. 467.

OPTICAL GLASS.

New Optical Glasses.—Walter Rosenhain, in a paper before the Optical Convention, discusses the possibility of preparing new optical glasses by crystallisation, and takes the view that further progress in the manufacture of optical glass may be made by a study of the nature and mode of production of large mineral crystals.—"B.J.," June 9, 1905, p. 449.

Polishing Glass Surfaces.—Lord Rayleigh, in a paper before the Optical Convention, expresses the view that polishing a glass surface with rouge embedded in pitch or carried on a softer material is essentially a different operation from grinding. No visible pieces of glass are broken away. Polishing begins upon the eminences left by the grinding; little facets are first produced on these eminences, and soon reach a size sufficient to allow of a certain degree of regular reflection. Their area increases as polishing proceeds, but there is no progress in the polishing. The polish is perfect, where it exists, from the very first.

Very dilute (1 in 200) hydrofluoric acid was found to act very regularly on glass—so regularly as to make it practicable to eat away the surface to any required small depth, such as half a wave-length. The acid acts in such a way as to eliminate from the roughened surface all the finer irregularities, leaving only those of longer periodicity.—"B.J.," June 23, 1905, p. 485.

Discolouration of Glass in Light.—Sir Wm. Crookes records the colouration of glasses containing manganese in bright light at high altitudes, and explains the action as that of light of short wave-length. At a height of 4,000 metres nearly half the atmosphere is beneath our feet, and that which remains will allow

rays of shorter length to pass than will the atmosphere at sea level.—"Chem. News," February 17, 1905, p. 71; "B.J.," March 24, 1905, p. 231.

F. Fischer confirms these observations in experiments on manganese glass for mercury-vapour lamps exposed to ultra-violet light.—"Chem. News," April 28, 1905, p. 192.

E. S. Simpson notes purple colouration of glass to be very frequent in Western Australia.—"Chem. News," May, 26, 1903, p. 236.

PROPERTIES OF LENSES.

Symmetrical Lenses.—S. D. Chalmers examines the optical conditions of lens combinations of this type, and shows that, subject to the errors introduced by the want of correspondence of the stop and its image, the combined system is completely corrected for astigmatism, curvature of field, and spherical aberration, provided the back component is so corrected. This want of correspondence introduces some slight errors, but in practical systems these are almost negligible.—"Proc. R. S.," February 24, 1905, p. 396.

Types of Lenses.—O. Mente cites the opinions of leading opticians on pros. and cons. of (*a*) anastigmats of several separate glasses, and (*b*) those consisting of cemented combinations, as regards rapidity at equal aperture, in view of the absorption of light by thick lenses and reflection by a number of glasses. Dr. Harting (Voigtländer) says the difference is negligible, but there is a limit, and a double 4-lens system means great loss of light. Dr. Rudolph (Carl Zeiss) dismisses the difference between cemented and uncemented lenses as trifling. Steinheil regards exact comparison as difficult. He prefers cemented-lens systems for outdoor photography, as less liable to reflex images, and uncemented lenses for projection and photography in diffuse light as in a studio. Martin states the loss of light with a triplet to be 10 per cent. more than a doublet, and a quadruplet 10 per cent. more than a triplet. The loss by absorption, when 5, 6, 8, or 10 lens are used, he regards as appreciable.—"Phot. Korr.," 1904, p. 540; "B.J.," December 30, 1904, p. 1104.

Double Objectives.—The Rathenower Optische Industrie-Anstalt, formedly Emil Busch, have patented the following lenses:—Fig. 1. A doublet corrected for spherical, chromatic, and astigmatic aberrations and coma, formed of a cemented Gauss objective and an over-compensated meniscus. (Ger. Pat., No. 241,219.) Fig. 2 is a triplet consisting of two concavo-convex lenses, with a central biconvex lens; this is corrected for spherical and chromatic aberration and coma. The following are the data for a lens of 240 mm. focus:—

			nD	
$r_1 = -r_6 = 132.6$	$d_1 = d_5$	$= 5.3$	1.61	0.318
$r_2 = -r_5 = 37.5$	$d_2 = d_4$	$= 15.4$		
$r_3 = -r_4 = 53.0$	$d_3 =$	$= 58.1$	1.61	0.2994

In place of the single lenses cemented systems of similar external form may be used. (Ger. Pat., No. 241,222.)

Fig. 3 is a doublet composed of a meniscus in front, and a meniscus and a concavo-convex lens at the back. The lenses may be reversed, and cemented lenses may be used instead of single. Spherical, chromatic, and astigmatic aberration are corrected as well as coma. (Ger. Pat., No. 241,21.)

Fig. 4 is a doublet consisting of a meniscus, composed of two glasses of approximately the same refraction but different dispersion, and a Gauss system. The aberrations as above are also corrected. (Ger. Pat., No. 241,241.)

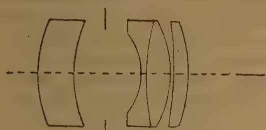


Fig. 1.

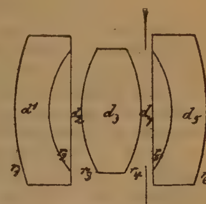


Fig. 2.

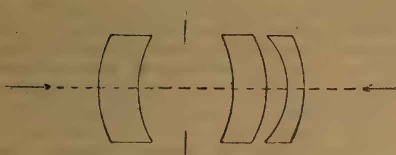


Fig 3.

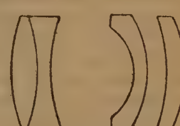


Fig. 4.

The "Imagonal" is a lens made by G. Rodenstock, of Munich, from calculations by A. Neumann. The front combination consists of three cemented glasses—a double convex, double concave, and meniscus; the back lens, of a single glass. Designed on the Rudolph principle of anastigmatic flattening of a spherically corrected system, the indices of refraction of the glasses in the front lens are so chosen that that of the middle negative lens falls between that of less highly refractive meniscus and high refractive crown bi-convex. In this respect the lens resembles Dr. Rudolph's Satz Protar and the Goerz Series III., but differs from these lenses in that some aberration is left in the front lens, but is corrected by the posterior meniscus. The lens is stated to work at *f*/6.8 without spherical aberration.—"Phot. Korr.," November 1904, p. 503.

ABERRATIONS.

Aberrations of Lenses.—Dr. C. F. Drysdale, before the Optical

Convention, classifies and suggests expressions for the following aberrations :—

(*a*) Chromatic aberration of the image plane.
(*b*) Chromatic aberration of the magnification.
(*c*) Central spherical aberration.
(*d*) Coma.
(*e*) Radial astigmatism.
(*f*) Curvature of the field.
(*g*) Distortion.

The following definitions are advanced for aberrations of the first order :—

Central Chromatic Aberration.—In this case there can be little doubt that, so far as instruments intended for visual observation are concerned, whether objective or subjective, the standard plane should be that for the D line, and the chromatic aberration of the image plane should then be the diameter of the disc formed on the axis at full aperture for either the C or F line, whichever is larger. For photographic instruments the standard plane might still be for the D line, and the size of the disc for the F or G line might then express the chromatic error.

Chromatic Differences of Magnification.—Here the amount of the error would similarly be the distance of the focus of a narrow pencil passing through the centre of the diaphragm for the C, F, or G light respectively from that for the D light on the plane at some specified angle of view. This angle would probably be the extreme nominal covering power of the system when this is known.

Spherical aberration would be on this basis the diameter of the disc produced at full aperture on the axis on a plane focussed for a narrow central pencil using sodium light.

Coma might be defined as the difference between the distances of the top and bottom edges of the patch formed by an oblique pencil at the specified angle, and at full aperture from the position on the plane to which the centre of the incident pencil is refracted.

Radial astigmatism would similarly be expressed by the difference between the diameters of the elliptic patch formed on the standard plane at full aperture and at standard obliquity, or their sum if the primary and secondary foci lie on opposite sides of the standard plane.

Curvature of the field might be measured by the mean diameter of the patch, or the half difference of the diameters when the focal lines fall on opposite sides of the screen at full aperture and standard obliquity.

Distortion on the basis of these considerations would be measured by the displacement of the image for a narrow pencil at the standard obliquity intersecting the axis at the centre of the diaphragm, from the position given by the Gauss relations. If x_2 is the lateral distance of the image from the axis, x_1 that of the object, then $x_2 - mx_1$ will be the distortion, m being the Gauss magnification $\frac{v}{u}$.—"B.J.," June 2, p. 425; June 16, 1905, p. 466.

Correction of Negative Zonal Aberration.—K. Martin gives the following data for a lens in which the correction of negative zonal aberration is effected by the introduction into the flint lens of a deeply curved lens of lower refractive index.

Fig. 1 shows the half of a system of the "Omnar" type (Busch Anastigmat), focus 210 mm., largest aperture for the spherical aberration was F/11.

$R_1 = -22.36$	$D_1 = 6.15$	$n_1 = 1.6031$
$R_2 = -42.56$	$\Delta = 3.31$	Air
$R_3 = -383.35$	$D_2 = 5.73$	$n_2 = 1.4967$
$R_4 = -33.64$		

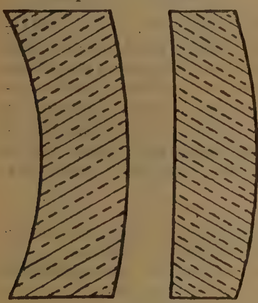


Fig. 1.

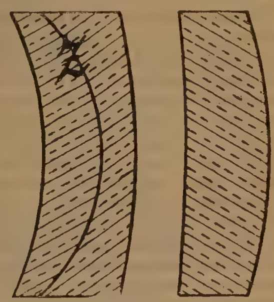


Fig. 2.

Zonal aberration = —0.53 mm.; that is to say, the focus of the abaxial rays is 0.53 mm. longer than the central or marginal rays.

Fig. 2 shows the improved lens, focus 204.01 mm., aperture F/11.

$R_1 = -22.36$	$D_1 = 3.83$	$n_1' = 1.6031$
$R_1' = -13.17$	$D_1'' = 2.29$	$n_1'' = 1.6131$
$R_2 = -42.56$	$\Delta = 3.29$	Air
$R_3 = -383.35$	$D_2 = 5.70$	$n_2 = 1.4967$
$R_4 = -35.52$		

Zonal aberration —0.07 mm.—"Cent. Zeit. Opt.," March 15, 1905, p. 68.

LENSES IN PRACTICE.

Graphic Calculation of Focal Length, etc.—A. Lockett shows how to work out by graphical methods the ordinary lens calculations, such as equivalent focal length, conjugate foci for a given size of image for a lens of given focus, etc.—"B.J.," May 5, 1905, p. 347.

Diaphragm Numbers.—F. M. Steadman advocates an extraordinary system of diaphragm numeration, based on a "cone-unit" of light, said to be "1-64th the convergence of a hemisphere."—"B.J.," May 5, 1905, p. 349.

Large Aperture of Lens.—Josef Switkowski comments adversely on the Grün fluid lens, and prefers for its lesser weight the Zeiss telephoto positive of four cemented lenses and aperture $f/3$. By mounting two such lenses in a tube a quasi-aplanat is obtained

of $f/1.5$ aperture. Two lenses of 125 and 375 mm. focus give a double lens, which covers a 6×6 cm. plate, and is suitable for portraiture. It is pointed out that the want of flatness of glass plates, defective register of dark slides, etc., minute as they are, destroy the practical value of such high aperture lenses.—"Phot. Mitt.," December 2, 1904, p. 375.

Anachromatic Lenses for Portraiture.—C. Puyo discusses the suitability of lenses with spherical and chromatic aberration for portraiture, and concludes that chromatism is an advantage, for when the plate is placed at the focus of the violet rays :—

1. The strength of the drawing is determined by the predominant action of the violet image, which is sharp.

2. The surfaces are lightened and their modelling simplified by the action of the coloured circles, the details without importance being obliterated. Thus, for example, on a face the freckles disappear.

3. As the breadth of this diffusion circle is proportional to the absolute diameter of the diaphragm, the chromatic softness of the drawing with objectives of equal ratio aperture is in exact ratio to the focus. The result of this is that the synthesis will increase with the size of the picture.

All these peculiarities are of advantage.

M. Pulligny, of the Photo Club of Paris, two years ago laid down the principle of the "anachromatic" lens.

M. Puyo has used for two years :—

1. A plano-convex lens of crown glass, which is specially suitable for studies of heads. It has a ratio aperture of $f/5$.

2. A simple meniscus, a concavo-convex positive lens for studies in rooms, with a ratio aperture of $f/10$.

3. A symmetrical objective of two identical meniscuses of crown glass. This objective gives with ratio aperture of $f/5$ very homogeneous pictures.

4. A telephotographic lens, with this symmetrical lens as a positive and a plano-concave lens, also made of crown glass as the negative element. With this lens one can obtain heads in life size at a distance of four metres.

M. Pulligny has constructed another series of lenses which he calls "semi-anachromatic," in which the chromatic aberration is correspondingly reduced.

One of the principal advantages of all these lenses is that without great expense one can use lenses of very long focus; the price is in fact nominal. These lenses enable the amateur to observe the laws of perspective. He will soon discover that the foci of the anastigmats are ridiculously short, and will use foci of from 80 to 100 cm. Above all, with these lenses, actual portraits can be made, heads in half, three-quarter, even of full life size, heads of broad modelling—thanks to the chromatic aberration—and of true "painter-like" impression.—"Deutscher Camera-Almanach," 1905; "B.J.," January 6, 1905, p. 5.

Puyo describes one form of these lenses called the "adjustable landscape" lens; it is formed of an anterior plano-convex crown, and a posterior plano-concave crown, each

possessing a focus of 10 cm. and the same radii of curvature. When in contact the focus in infinite, by separation the focus can be lengthened, the diameter of the front lens is 3 cm. The foci obtained are variable with the extension of the camera, from the formula $F = f^1 + \frac{f^1}{f^2} T$, in which f^1 is the focus of the positive and f^2 the focus of negative and equal. To obtain longer focus the ratio of foci of the two lenses is chosen as 4 :3, and that of the positive as 20 cm.—"Revue de Phot.," September, 1905, p. 257.

Supplementary Lenses.—In calculating the focal length of an added lens, needed to reduce or increase a given lens to a given focal length, a rapid method is as follows :—

$\frac{1}{F} = \frac{1}{f^1} + \frac{1}{f_2}$, F being the focal length of the whole lens and f_1 f_2 that of its components. If the focal length is to be negative, a minus sign must be prefixed.

Thus to convert a 6-inch lens into a 9-inch lens :—

$\frac{1}{9} = \frac{1}{6} - \frac{1}{f_2}$

$\frac{1}{_2} = \frac{1}{6} - \frac{1}{9} = \frac{3}{54} = \frac{1}{18}$ *i.e.*, a negative lens of 18 inches focal length is required.—"B.J.," November 4, 1904, p. 945.

[This formula neglects the separation of the lenses; the complete expression for $\frac{1}{F}$ is $\frac{1}{f_1} + \frac{1}{f_2} - \frac{a}{f_1 f_2}$ where a is the (nodal) separation of the lenses.—ED., "B.J." Almanac.]

Depth of Focus.—The Rev. T. Perkins, M.A., gives the following rule for finding the distance from the lens of any point intermediate between two others, which must be focussed upon in order that these two may be represented with equally sharp definition. u^1 and u^{11} being the distances of the two points, the distance, u, of the point required is equal to twice the product of u^1 and u^{11} divided by their sum, *i.e.*, $u = \frac{2u^1 u^{11}}{u^1 + u^1}$.

Also if we focus accurately the object at the distance u, then the one at distance u^1 will be in as good focus as one at distance u^{11}, provided that $u = \frac{2u^1 u^{11}}{u^1 + u^{11}} = \frac{2u^{11}}{1 + \frac{u^{11}}{u^1}}$.

Now make u^1 infinite, and we get $u = 2u^{11}$, or $u^{11} = \frac{u}{2}$.

This shows that if instead of focussing so that the object at an infinite distance is in absolute focus, we focus so that the circle of confusion for a point at infinity has a diameter not exceeding 1-100 in., then an object at only half the distance given in the tables will also be in appreciable focus.—"B.J.," May 19, 1905, p. 384.

A Universal Focussing Scale.—J. H. Taylor describes a "depth" indicator as a substitute for depth of focus tables. It consists of two parts, first the scale of distances at their proper intervals apart for each lens, and, secondly, the indicator on which the stop numbers are marked.—"B.J." April 28, 1905, p. 324.

New Focussing Rules for Hand-Camera Work.—Professor Pflaundler, after treating of the subject from a mathematical point of view, gives the following two simple rules for focussing, which may be useful to hand-camera workers :—1. (Applicable when the background is not very distant.) Focus on a distance equal to twice the product of the greatest and shortest distance, divided by their sum. Example.—Suppose the subject to be a street scene, with a house front 20 yards away and a man 5 yards away, and that both are required sharp, then $(5 \times 20) \div (5 + 20) \times 2 = 8$ yards, the required point to focus on. 2. (Applicable when the background is infinity.) Focus on a point just double the distance of the nearest point. Example.—Again assuming that the nearest point is 5 yards, then $2 \times 5 =$ yards the point to focus on. To find what stops must be used to give an error of confusion not exceeding 1-250th of an inch, the rule is : Multiply the allowable error by the focus and divide by the distance focussed on focus, all measurements to be in inches.—"Eder's Jahrbuch," 1905, p. 125.

Depths of Focus.—Rules for "depth" when objects are close to the camera are given as follows :—(1) To find the nearest distance in focus, multiply the hyperfocal distance by the distance of the object, and divide the result by the hyperfocal distance plus the difference between the distance of the object and the focal length. (2) To find the farthest distance in focus, multiply the hyperfocal distance of the object, and divide the result of the hyperfocal distance minus the difference between the distance of the object and the focal length. The hyperfocal distance is always equal to the focal length, multiplied by the diameter of the stop, and divided by that of the circle of confusion.

Thus, in the case of a 5 in. and 10 in. lens, with aperture $f/16$, and focussed on a point 10 in. to 20 in. respectively :—Taking 1-100th in. as the circle of confusion we find by these rules that with the 5 in. lens

$$\text{depths extends from } \frac{\frac{2{,}500}{16} \times 10}{\frac{2{,}500}{16} + 5} \text{ to } \frac{\frac{2{,}500}{16} \times 10}{\frac{2{,}500}{16} - 5}$$

or from 9.69 in. to 10.33 in.
so that the total depth is only .64 in.
With the 10-in lens

$$\text{depth extends from } \frac{\frac{10{,}000}{16} \times 20}{\frac{10{,}000}{16} + 10} \text{ to } \frac{\frac{10{,}000}{16} \times 20}{\frac{10{,}000}{16} + 10}$$

or from 19.685 in. to 20,32[illegible] in.
and the total depth is .64 in.

The total depth is thus the same with both lenses, but it will be noticed that the near and far limits of depth are relatively nearer the lens in the second case. It is not likely that any lens will work exactly to these figures, and they are only rough guides.—"B.J.," October 27, 1905, p. 860.

Telephoto Calculations.—Charles Louis Hett discusses the speed of telephoto lenses when employed on near objects.—"B.J.," June 16, 1905, p. 463.

Blackening Stops.—To re-blacken stops the following method is advised:—They must first be cleaned from every trace of grease by rubbing with strong soda solution, then well washed, and immersed in a solution of potassium sulphide, and boiled, till sufficiently black, and then rinsed and dried and rubbed with oil or vaseline. In inexperienced hands this is said to give better results than the usual silver and copper method.—"Phot. Rev.," September 10, 1905, p. 88.

LANTERN OPTICS.

Lantern Optics.—C. Welborne Piper instances a number of misconceptions as to the optics of the projection lantern. The condenser should *not* form an image of the light at or near the node of the projection lens as the necessary condition of the even illumination of the screen. The image will usually be found slightly in front of the lens, and its position varies considerably with the quality of the optical system and the distance of the screen.

Dark patches on the screen, due to wrong position of the light, actually have their cause in spherical aberration: the dark central spot, produced when the light is too far back, arising from over corrected or negative spherical aberration. A disc with dark margins, indicating a light too far forward, is characteristic of under corrected or positive spherical aberration.

Another fallacy is that even illumination is secured, when the come of light from the condenser just fills the back lens of the projector, but it will usually be found that the cone only fills the back lens of the projector, when a small disc is being projected on a very near screen.

It is not certain that there is any material advantage in a perfect condenser free from all aberration.

To produce a perfectly even disc, without any aid from the projector, the condenser would have to be, not only free from all aberration, but also so designed as to illuminate the slide or negative with perfect uniformity. If this latter condition were neglected the illumination of the slide would only be equivalent to that of a plane surface lighted from one small point of light. The illumination would fall off towards the margins, and this effect would be repeated on the screen, in the absence of any corrective action on the part of the projector. We should then either have to obtain a condenser of an almost impossible degree of perfection, or rely to a certain extent on the projector. Even if we did obtain the perfect condenser the whole optical system would only work perfectly and in accord with the nodal theory for one fixed distance of the screen. Any variation of the

distance would introduce aberration in the condenser beam, and the projector would then have to step in and correct it. It appears that it is owing to the imperfections of the two elements of the ordinary lantern system that we can attain such satisfactory illumination under a great variety of conditions, provided only that the condenser and projector are well adapted to work together.

The ordinary imperfect condenser has the further advantage that it does not require an extremely small source of light. A perfect condenser would not work perfectly in accordance with theory except with a light source of the smallest possible dimensions, which is not a desirable form of light for ordinary projection purposes with optical or enlarging lanterns. It is very commonly asserted that the smaller the light the better is the result, but, from the point of view of the practical lanternist or enlarger, a very small light is anything but an advantage. What is wanted is a perfect representation on the screen of just the one image plane of the slide or negative, but with a very small source of light we also get shadow images of every speck or imperfection on any of the numerous surfaces of condenser, plate, or cover glass. In the optical lantern the light passes through eight or ten such surfaces before it reaches the projecting lens, and, while only one of the surfaces is desired to be represented, it is impossible to keep all the rest speckless. With a very small source of light even a small speck may be a complete obstruction and cast a black shadow, but with a larger source no ordinary defect can stop more than an inappreciable amount of light or give a definite shadow. Hence a light source of disc form and of moderate dimensions is by far the best for practical purposes.—"B.J.," October 6, 1905, p. 785.

LENS TESTING AND MEASUREMENT.

Lens Testing.—S. D. Chalmers, M.A., gives the following methods for making very sensitive tests of photographic lenses :—

1. Hartmann method: A diaphragm with small circular apertures in it is placed before the lens, so as to obtain small isolated beams of light passing through the lens system. If a photograph be taken at the focus of the lens, an image of the small, bright light placed at a great distance from the lens is obtained; but the test is made by taking two photographs inside and outside the focus, and, as nearly as possible, equidistant, about 15 mm., or more in the case of very bad lenses, from it. The diaphragm is provided with apertures in vertical and horizontal lines, so that the various rays of light will cross over at one particular spot, and according as they do so or not, the lens is good or inferior. In practice, the lens is made to swing about a vertical axis, approximately through the back nodal point, exposing, with the one light, the various portions of the plate in succession. The illumination is an electric arc light, condensed on a small aperture of about 2 mm. diameter, placed at a distance of 9 metres. The diaphragm is placed as nearly as possible in the position of the iris of the lens system, partly

because this indicates the cutting off of the lens for different angles, but principally in order that the actual results obtained should conform to the usual nomenclature of aberrations. For example, the position of the focal lines, as distinguished from the effect of coma, are obtained from the intersections of rays equidistant from the centre of the stop, while the value of the coma is obtained from the distance between the central line and the intersection of these two outer beams.

It is characteristic of this method as distinguished from all other methods that the aberration of coma is shown as a definite measurable quantity, and all the defects of a lens can be measured or, when they exceed a certain amount, easily seen.

The labour of taking the photographs is much reduced by swinging the camera about the nodal point of the lens, but the labour of measuring the photographs is very great. For simplification I use a drawing camera, the microscope magnifying 50 to 75 times; it is then possible to draw the centres of the various spots with an accuracy of 1 mm., *i.e.*, 1-50th mm. to 1-75th mm. on the original plate. The various points in one diagram are joined up to the corresponding points in the other, and any variation made by the lines in crossing gives the longitudinal aberrations.

The distance between the two photographs should be recorded, as this enables the aperture ratio corresponding to each opening of the diaphragm to be subsequently calculated.

A photographic lens may be regarded as perfectly corrected when no aberration exceeds .1 mm., *i.e.*, when no error of 10 mm. is shown in the drawing, when each photograph is magnified fifty times.

2. Zschohke method: Results are obtained at one exposure on a photographic plate. The object is a flat diagram of horizontal and vertical lines, or of circles and radii. And either the object or the plate is placed at an angle of 10 degrees to 15 degrees to the axis of the lens. The image is focussed in the centre of the ground glass, and an exposure made at the aperture which it is desired to test. The negative will fall off in definition at the top and bottom, but with a perfect lens the best definition will be along one horizontal line. Any defect in the nature of spherical aberration is shown by the absence of good definition at any point, while the amounts of astigmatism and curvature of field can be charted out and numerical estimates obtained if the points at which the horizontal and vertical lines appear sharpest be marked on the plate. A sheet of well printed matter will serve as a good test object.—"Phot. Journ.," April, 1905, p. 143; "B.J.," April 28, 1905, p. 328.

The subject is further discussed by the same writer in a paper before the Optical Convention.—"B.J.," June 2, 1905, p. 427.

Dr. Glazebrook describes the Hartmann and other methods of lens testing used at the National Physical Laboratory.—"Phot. Journ.," January-February, 1905, p. 50.

Measuring Lens Curves.—Dr. C. V. Drysdale measures the curvatures of small (microscopic) lenses with an instrument as

follows :—Parallel light from a distant source falls upon a plain unsilvered mirror, *e.g.*, a plain sheet of glass, inclined at an angle of 45 degrees. Some of the light is reflected, and brought to a focus, by an ordinary convex lens. The surface to be tested is placed at this point, and reflected rays proceed as if they had come from a point on the surface. They pass through the plate glass into a telescope focussed for parallel rays, and an observer sees an image of the distant source. If the surface is convex, and is brought nearer to the lens, thus, when it reaches such a position that its centre of curvature is at the focus of the rays emerging from the lens, the light will again retrace its former path, and a distinct image of the source will be seen in the telescope. In order to obtain the two images, the surface has, therefore, been moved through a distance equal to its radius of curvature. If the surface is concave it must be moved away from the lens.—" B.J.," December 9, 1904, p. 1042.

Measuring Absorptions of Tinted Glasses.—L. W. Phillips, describes the use of the Flicker photometer for this purpose, the method being drawn up for application to the Simmance Abady photometer of the Flicker type. The principle of the photometer is the bringing of two surfaces, illuminated by two sources of light, alternately into view at a certain periodicity. If unequally illuminated, a throbbing or flicker effect will be noticed. This effect may be due to the pupil of the eye failing to keep time with the rapid change of intensity of illumination of the two screens. The fact that two surfaces, each illuminated by light of a different colour, can be measured for intensity in this way is ascribed to the differences in the senses of lightness and colour, the former being much keener and quicker in action than the latter. In the Simmance Abady type of Flicker photometer, light from the two sources is received upon a wheel of pure white material, which is rotated at a known and controllable speed by a clockwork motor. The periphery of the wheel is formed of two equal conical surfaces, and when it revolves the intersection of the two surfaces crosses the line of sight. The two surfaces are seen alternately on looking through an eyepiece. The photometer being placed between the two sources of light, so that they are at right angles to the line of sight and parallel with the axis of the wheel, the effect produced by each light is seen when the wheel rotates. The author employed a bench 2 metres in length when making the measurements. The illuminants were enclosed in blackened boxes with an aperture in the front. The first adjustment is made to equalise the illuminations of the unscreened lights, and then the glasses, the absorptions of which are to be measured, a e inserted, and a second reading taken. The most satisfactory source of light was found to be either an Argand burner for gas or a small glow-lamp with straight filaments, supplied with current from accumulator.—" Brit. Opt. Jour.," March 15, 1905, p. 165; " B.J.," February 17, 1905, p. 134.

Some Notes on the Use of Tourniquet. (For measurements of focal length, effective apertures, etc.) C. Welborne Piper.—" B.J.," September 1, 1905, p. 687.

Instantaneous Shutters.

SHUTTER DESIGN.

William Taylor discusses the construction of an accurate and efficient between-lens diaphragmatic shutter, for which purpose the diaphragm must open and close very rapidly, and must, therefore, be as light as possible. It is found possible to construct an iris of four leaves each) of the form shown in Fig. 1), only weighing in all 13 grains, and operated by four crossed links, weighing only 17 grains. To control the duration of time during which the shutter remains open, it is usual to use a pneumatic regulator, not to vary a rate of motion, but to measure intervals of time. Accordingly, it has been found that the packing of the piston and the variable air exit may both be dispensed with, the piston is fitted loosely within the cylinder, the air escaping between them acts as a lubricant, and intervals of time are varied, not by varying the rate of the piston's motion, but by varying the distance through which it moves.

In the ordinary shutter, which is intended to control times varying between one second and one-hundredth of a second, if

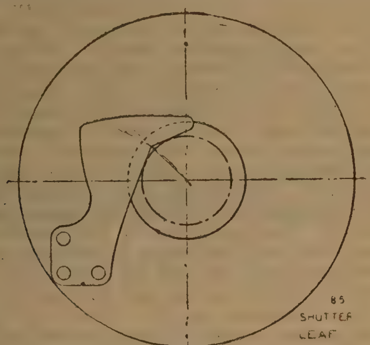


FIG. 1.

the distance through which the piston moves when measuring one second be, say, half an inch (and it is limited by the need for compactness) then the distance through which it moves when measuring 1-100th inch is only 5-1000ths inch, and the trouble is this: that with an elastic substance like air, which has to be compressed in volume before leakage will occur, that small interval of 1-100th second, and even longer intervals, are generally occupied in compressing the air and by the effects of impact and inertia, and there is no time for the leakage, upon which we depend for time measurement, to come into play. This is why, in the ordinary shutter, as is well known, the three or four shortest exposures are practically the same, and not as marked on the

dial. The remedies for this defect must be sought in increasing the rigidity of the air cushion, and in reducing the inertia, and controlling the impact of the moving parts.

In effecting this regulation it should be recognised that air is much more rigid in compression than in extension, and, further, in securing accurate measures of short time intervals it is important to control the effect of impact on, and the inertia of, the moving piston.

In being moved to measure a very short time interval, it is inevitable that the piston be moved quickly. But if it be suddenly struck by the part which actuates it, the energy which the piston thus receives may carry it at once beyond the point required, and the effect of air leakage on the timing of the shutter will be lost.

It is the usual practice in shutters to strike the piston in this way, in order that the pneumatic device shall act also as an air cushion to stop the opening shutter without shock. This use as a buffer is, however, quite inconsistent with the true purpose of the pneumatic regulator, and to abandon it leads to very much greater accuracy in the control of short time intervals.

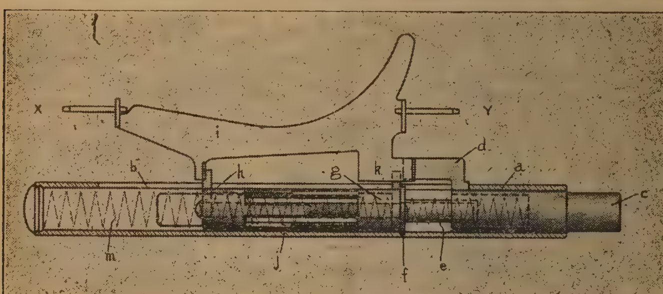


Fig. 2.

Also, by using springs in compression instead of in extension (as is usually done) as a source of energy for the shutter, the construction can be made much more compact, and the simple arrangement shown in Fig. 2 becomes possible.

The tube *a* having a slot *b* along it contains the push button *c* whose wing *d* projects through the slot in the tube. A spring *e* thrusting against the fixed stop *f* serves to return the push button after it has been pressed.

The pieces *g* and *h*, which slide freely within the tube, have pins projecting through the slot *b* and engaging with the piece *i*, which is called a gate, because its business is to permit or prevent, as required, the passage of the pins and their sliders, *h* and *g*. The gate is pivoted on the axis *xy*. Between the sliders *g* and *h* is the mainspring *j*, which is compressed through the medium

of the pin of *g* and the wing *d* when the button *c* is pressed. As this is being done, the slider *h* tries to go forward, but is obstructed by the stop on the gate. The face of this stop is sloped so that the tendency is to depress the gate, but this is prevented because the pin of *g* is yet beneath the part *k* of the gate. When, however, the pin of *g* has been pushed just beyond the part *k*—that is, when the mainspring is fully set—the gate falls, the part *k* obstructs the return of the slider *g*, the slider *h* shoots forward and opens the shutter to which it is connected, and at the same time compresses the spring *m*, whose duty it is presently to close the shutter by returning the sliders to their normal position.

This occurs when the gate is moved so that the part *k* no longer obstructs the return of the slider *g*.

In the case of exposures whose duration is determined by hand,

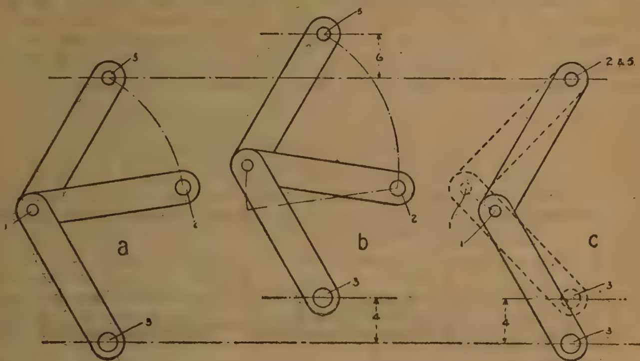


Fig. 3.

the gate is moved for this purpose by a second motion of the push button *c*, and to terminate exposures automatically the gate is moved by the operation of a spring, set in action by the opening of the shutter delayed in its action by the variable obstruction of the pneumatic piston, and which finally moves the gate and permits the shutter to close. By this arrangement, among other things, the important principle already laid down has been observed, and the impact of the moving part has been taken away from the pneumatic piston. Moreover, the spring which operates the piston, having no other function, can be made adjustable as to strength, so that the longest time to be controlled—the second—can be accurately adjusted, and the very shortest time to be controlled may be adjusted by means of a screw whose point at the required time actuates the gate. With the extreme time intervals thus adjustable, the intermediate times, which

depend upon the shape of a fixed cam, are included in the adjustment and made correct.

In every diaphragmatic shutter, that is, one of which the full aperture may be varied at will, the problem has to be met of getting, from the motor mechanism, whose motion is constant in amount, a variable motion of the diaphragm. Fig. 3 shows a simple solution of this problem. At *a*, three links are shown pivoted together at 1. The end 2 of the middle link is pivoted to some fixed part of the instrument. Now, if motion be imparted to link end 3, so as to move it up to the position shown at *b*, through the distance 4 the other link end 5 of the series, if suitably constrained, will move though a distance 6 exactly equal to 4. But if the end 2 be pivoted, not as at *a* and *b*, but coincident with 5 as at *c*, then the full motion of the link end 3 will produce no motion whatever of the end 5. By moving 2 to any intermediate position it is clear that we get from a motion at 3 constant in amount, a variable motion at 5. With the end 3 of this linkage connected to the motor, and the end 5 to the diaphragm, this simple device forms a perfect means of obtaining the diaphragmatic action.—"Phot. Journ.," January-February, 1905, p. 34; "B.J.," February 24, March 3 and 10, 1905.

FOCAL-PLANE SHUTTERS.

Faint bands in negatives made with focal-plane shutters are seen when a very narrow slit is used, and are due to want of parellelism, of course, of the slit and the plate. This follows from the fact that the efficiency of the slit is greater at one point than at another, and the writer, drawing attention to it, further notes the occurrence of bands irregularly alternating between light and dark, which are formed on the plate at right angles to the slit. They seem to be due to the rough or irregular surface of opposing portions of the slit. The two edges of the slit are not perfectly smooth, and at points where two prominences face each other, the exposure is lessened and a light band results. The effect only occurs with a very narrow slit, and more usually under strong lighting.—"Phot. Mag.," 1904, Nos. 32 and 38.

Efficiency.—Herr K. Martin points out that an efficiency of 50 per cent. is very low for a roller-blind lens shutter, representing a square aperture moving across a circular one of diameter equal to its side. Such a shutter is at the bottom of the scale, and with suitable design and mechanism shutters of 90 per cent. efficiency could be made. The efficiency of the focal-plane shutter is 100 per cent. if the slit is close to the plate; less, if appreciably removed from the plate. Impaired efficiency is noticeable the greater the aperture of the lens, and the narrower the slit. The formula is :—

$$\frac{\text{Lens aperture in mm} \times \text{distance of slit from plate in mm.}}{\text{Focal length of lens in mm.}}$$

= smallest width the slit can be, if it is to employ the full aperture of the lens.—"Phot. Mitt.," 1904, p. 340; "B.J.," January 20, 1905, p. 45.

W. Schmidt discusses the action of the focal-plane shutter removed from the plate as regards speed and efficiency, and the influence thereon of the width of slit and the aperture of the lens.

Rapidity.—With the plate some distance behind the slit, it must first be found how many times the slit must move the distance of its own breadth to reach the point at which no further light reaches the surface corresponding to it in this ulterior position. This number, multiplied by the time during which the slit actually moves through its own breadth, gives its rapidity in the rear position.

Efficiency.—The author gives a table for efficiency at single and double extension, and states the rule that when the width of the slit is half the diameter of the diaphragm, the illumination is the same in each case.—"Zeit. Wiss. Phot.," November, 1904 (Heft 9 and 10), p. 352; "B.J.," January 27, 1905, p. 64.

C. J. Stokes disputes Schmidt's formulæ, and discusses "efficiency" and illumination by considering the light action at a point instead of over a considerable area. Assuming that a distant point of light is in focus, and the lens has a square diaphragm, defining "efficiency" as the number of times the width of the pencil of light (where cut by the shutter) is contained in the width of the slit *plus* 1, it is concluded that the duration of a shutter of slit-width w placed $1/n$ the focus of the lens from the plate $= \dfrac{w + \frac{a}{n}}{w}$, a being the aperture of the diaphragm and the speed of the shutter in the focal plane being 1. The efficiency is $\dfrac{w}{w + \frac{a}{n}}$ and the illumination = duration × efficiency $= \dfrac{w + \frac{a}{n}}{w} \times \dfrac{w}{w + \frac{a}{n}} = 1.$ Hence it is concluded that though speed varies considerably with the position of the blind in the camera, the effective exposure does not vary.—"B.J.," February 10, 1905, p. 118.

Negatives showing an evenly graduated decrease of density or exposure from top to bottom, incompatible with the subject rendered, proved to have been exposed with a focal-plane shutter defective in that the width of the slit altered during the exposure. This was particularly apparent when the smallest slit was used, and could be easily observed while the blind was being wound up. The shutter was of the enclosed spindle type. The pulley bands connecting the upper half of the blind with the lower were of a stouter substance than the blind material itself, and, while being wound up, accumulated on the ends of the spindle to a greater degree than the blind on the remainder of the roller, the result of this being that, as the shutter was wound up, the lower blind would be drawn nearer to the upper, thus decreasing the slit. Releasing the shutter reversed the action, resulting in in-

creased exposure for the bottom of the plate, *i.e.*, the sky portion.—"B.J.," April 7, 1905, p. 263.

Distortion with the Focal-Plane Shutter.—V. Behn and W. Heuse have made a series of photographs (with the focal-plane shutter) of a white band across a disc which is rotated at a speed of from 2 to 8 revolutions per second. They show the different forms of distortion which may occur, according as the movement of the shutter is with or against that of the object.—"Zeit. f. Wiss. Phot.," September, 1905; "B.J.," October 13, 1905, p. 807.

DIAPHRAGM AND SHUTTER ADJUSTMENT.

Adjustment of shutter and stop together is a novelty patented by Alfred Watkins and C. G. Woodhead, who state that it carries out a suggestion made in the Watkins' Patent, No. 5,737, 1900, viz., that, instead of making two separate adjustments of shutter and lens aperture, the setting of the latter should automatically adjust the former to the proper speed. In devising appliances for this purpose a diaphragm is constructed, such that the area of the iris aperture varies in the same proportion for equal amounts of the rotary movements of the iris plate slide. This movement is accomplished in several ways, two of which are shown in the accompanying figures. The claims are: (1) The

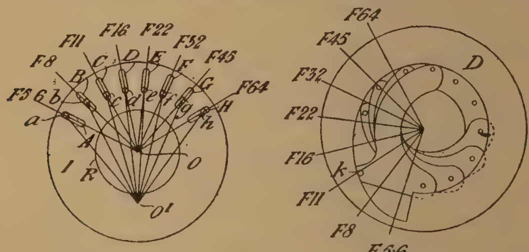


Fig. 1. Fig. 4.

(From patent specification.)

combination of an iris diaphragm with means for actuating it in which equal displacements of the actuating means produce a constant rate of variation of the area of the aperture. (2) An iris diaphragm, the leaves of which are actuated by a rotatable iris plate in such a manner that the angular displacement of the iris plate is proportioned to the logarithm of the area of the resulting aperture. (3) An iris diaphragm having the leaves formed, as shown in Fig. 1, for the purpose specified. (4) An iris diaphragm, the leaves of which are actuated by mechanism constructed and operating to effect the purpose herein specified, with reference to Fig. 4 of the accompanying drawings. (5) A lens mount for compound lenses, having an iris plate slide controlling the iris aperture in such a way that a common scale can

be used for lenses of different foci. (6) A lens mount provided with scales for the computation of exposures, in which one of the movable scale slides is arranged to alter the area of the iris aperture in such manner that successive equal displacements of the scale slide either double or halve the area of the iris aperture, according to the direction of motion of the slide.—Eng. Pat., No. 6,974, 1904.

Artificial Light.

MERCURY-VAPOUR LAMPS.

Mercury-Vapour Lamps.—W. Gamble, after reviewing the history of these lamps, proceeds:—

The lamp is constructed in the form of a glass tube, having platinum wires sealed in at each end. These wires lead the current to the electrodes. The vacuum is much higher than in the case of the ordinary electric glow lamp. The tube must in any case be of such shape as will permit of the ready flow of the mercury from one end of the tube to the other, as upon this depends the method of starting. One end of the tube is enlarged to a bulbous shape, and the mercury reposes in this when the tube is vertical.

The principle of starting the lamp is that when the current is switched on the mercury is disintegrated at the negative electrode, particles of mercury being thrown off and carrying the current to the positive electrode. Of the various ways in which this may be accomplished Cooper-Hewitt has selected two. One consists in discharging a high potential spark from an induction coil, and the other is by tilting the tube so that the mercury runs down to the other electrode, carrying the current with it. Lamps over four feet long can be lit in this way almost instantaneously.

When first installed the chief danger of spoiling a lamp is that the poles may be connected up in a reversed way, and even a momentary current through the reversed poles will spoil a lamp, rendering it unfit for any further use. It is necessary, therefore, to first carefully test with pole-finding paper or other means the polarity of the cables leading to the lamp before connecting the terminals. When once the lamp is installed there is little or no danger of any mishap, and the life of the lamp is theoretically infinite. Lamps used over 2,000 hours show but a slight decrease in candle-power. The best life of the average vapour lamp may be considered to be about 1,600 hours.

There is comparatively very little heat from the lamp. The temperature of the glass is slightly higher than that of an incandescent lamp bulb. The radiant heat, however, is not so great.

The most remarkable feature of the mercury-vapour lamp is the colour of the light. Apparently it is a cold, brilliant white; but if white objects are illuminated it imparts a greenish tinge to them. Red becomes a purplish hue, tending towards black. Gold becomes a light greenish bronze. Greens, blues, and violet appear more natural. Flesh tints are ghastly, a white face being

a sickly greenish hue, whilst any ruddy patches are a dark purple, as also are the lips. There is, however, plenty of colour, but it is not correct.

The cause of this eccentricity of colour is that there is no red whatever; but there are two bright orange lines which are difficult to obtain photographically with an exposure sufficient for the other parts of the spectrum. No yellow is to be seen, but there is a yellow-green line which is not very actinic, then a brilliant green line, a broad dazzling blue-violet line, and two more broad bands up to the end of the visible spectrum.

Ruby incandescent lamps have, however, been introduced in the vicinity of the tubes, and found to supply the proportion of red rays required. Ordinary incandescent lamps have also been found to tone the illumination owing to the yellow rays they emit. The most practical way, and the one which the Cooper-Hewitt Company have adopted for toning the illumination in the case of their studio apparatus, is to have a blind of a very light transparent silk dyed with a pinkish fluorescent dye. This takes away the glare, and introduces an appreciable amount of red into the light. The exposure can be made with the blind down, in which case the time is increased, or the blind may only be drawn over during focussing and posing the sitter.

In the form used for studio work, five of the mercury lamp tubes are mounted in a wooden frame measuring 5 ft. by 4½ ft., and hung in a sloping position near the ceiling or roof, thus forming an artificial "skylight." The frame can be hung at any angle and lowered at will. Each lamp is provided with a separate metal reflector, and works independently, so that only as many lamps as required need be used at one time, with a proportionate decrease in the current consumed. The "skylight" may be used for printing by having a framework to attach to it for supporting the printing frames.

The actual candle-power of the five lamps together, considered from an illuminating point of view, is 3,750, equivalent to over 115 32-c.p. incandescent lamps, but owing to the fact that the mercury lamp is so rich in actinic rays the effective illumination is far greater than would be obtained by an equal nominal candle-power from any other light.

For process reproduction two forms of the lamp mounted on floor stands are offered, one being started by the quick-break method and the other by tilting. The light is so diffuse that it will probably be found unnecessary to have two lamps—one on each side of the copyboard—except where very large subjects have to be lighted. It is found that a pair of Hewitt lamps taking eight ampères will do quicker and more satisfactory work than arc lamps taking 25 ampères. On 200 to 300 volts two sets of the Hewitt lamps may be run in series taking only three to three and a half ampères, and yet giving quicker results than even the enclosed arcs run in parallel, taking ten ampères each, or twenty ampères the pair.

For making bromide enlargements, lantern-slides, and transparencies, no condenser is required. Two 10-inch tubes are

mounted in a reflecting-box, which is pivoted to a baseboard fixed to the wall, and the lamps are started by the tilting method. The negative is placed in a carrier in front of the box, with a ground glass interposed, and a bellows and projecting lens used as in a daylight enlarging camera. The illumination is very even over the entire surface.

For printing, the lamp shows equally remarkable results. Two of the long lamp tubes are mounted in a frame, on each side of which are places for supporting seven 7 by 5 in. printing frames, so that fourteen prints may be made at once. As an example of the speed of printing, it may be stated that P.O.P. prints from an ordinary portrait negative are fully exposed in five minutes, and platinum prints with proportionate rapidity.

In carbon printing, for some unexplained reason—possibly the yellowness of the film obstructing the actinic rays—the light is somewhat slow, but for blue prints the light is from four to six times as efficient as arc lamps. Moreover, the form of the lamp adapts itself to the cylindrical copiers now so largely used.

With regard to the economy of the light compared with other forms of illumination, each lamp tube consumes one-third of a kilowatt per hour, or one-third of the Board of Trade unit on which all supply companies base their charges for current. Taking the price per unit at 6d., which is as high as is generally charged in this country, the price of running one tube will be 2d. per hour. The cost of running the printing lamp outfit will be 4d. per hour, and of the "skylight" outfit 10d. per hour when all the tubes are on. In the case of the photo-engravers' lamp, where two are run in series, the cost will only be 2d. per hour when the current is 6d. per unit; but as photo-engravers get very low rates, such as 2d., 3d., or 4d., the cost may be only a little under or a little over one penny per hour per pair of lamps. —"B.J.," February 3, 1905, p. 85; February 10, p. 894; February 17, p. 123.

Writing of the Bastian mercury-vapour lamp, Mr. Gamble gives the necessary current as 1-3rd ampère for illuminating power for 140 candles, measured by ordinary standards, but photographically of greater actinic power.—"B.J.," February 24, 1905, p. 144.

Cadmium Amalgam Lamp of Quartz.—O. Lummer and E. Gehrcke.—"Chem. News," January 20, 1903, p. 27; "B.J.," February 3, 1905, p. 82.

The Uviol Lamp.—Dr. O. Schott describes at length this new lamp, which is a mercury-vapour lamp, the main feature about it being the use of a new glass, which is extremely transparent to the ultra-violet rays. Its principal application seems to be for the light cure. The word "uviol" is a contraction from u(ltra)-viol(et).—"Phot. Woch.," April, 1905, pp. 15, 16, 17, 18.

The Uviol Lamp.—Dr. O. Schott describes this new lamp, made by Schott & Gen, of Jena. It is a mercury vapour lamp, but the main feature about it is the use of the "uviol" glass, which takes its name from the fact that it is extremely transparent to the ultra-violet rays up to γ 235. The lamp is usually made in the form of a tube of from 8 to 30 mm. diameter and from 20

to 130 cm. in length. Platinum electrodes are fused into the end of the tubes, and carbon knobs are fastened to the ends of the platinum wires, so that either pole may be used as negative or positive. According to the size of the lamp, from 50 to 150 gms. of mercury are used. The lamp is tilted to form connection between the two poles, the mercury flowing between them. The consumption of current is 0.64 watts per Hefner candle, and the intensity of the visible rays varies between 0.31 and 4.3 Hefner candles for every square centimetre of surface of the lamp turned towards the photometer. After the lamp has been running a short time, ozone can be readily detected in the air; the eyes must also be protected from the light. The life of the lamp is about 1,000 hours actually alight. Although specially devised for the so-called Finsen light cure, it will be useful in photography.—"Phot. Woch," Nos. 15 to 18, 1905, p. 141 et. seq.

On the "Absorption, Spectrum, and Fluorescence of Mercury Vapour," see a paper by W. N. Hartley, read before the Royal Society, reprinted in the "B.J.," October 27, 1904, p. 849.

ELECTRIC INCANDESCENT LAMPS.

The Tantalum Lamp.—Siemens & Halske have introduced a new incandescent electric lamp, the filament of which is composed of tantalum wire. The advantages are that this will stand a very much higher temperature, and there is a greater emission of light with corresponding reduction in the amount of current required: with 110 volts and 25 c.p. the consumption of current is only 1.5 watts. per candle-power.—"Phot. Woch.," April 18, p. 156.

The "Jupiter" Lamp (Jean Schmidt's Patent), constructed with a number of electric incandescent units, is described.—"Phot. Korr.," November, 1904, p. 507.

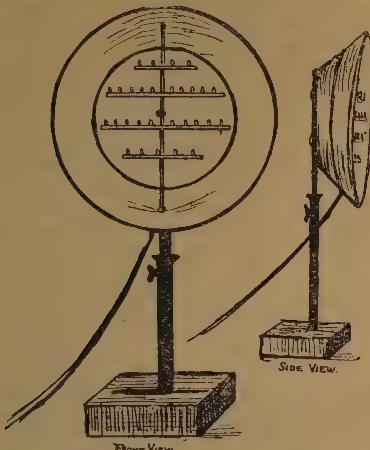
ACETYLENE.

Acetylene.—F. Brett avoids trouble with the sludge left in the generator by adding to the water in the first instance a fair amount of common brown sugar, which forms saccharate of lime (soluble) and so prevents the sludge sticking to the generator.—"B.J.," November 25, 1904, p. 1009.

Acetylene.—H. E. Corke adopts the following apparatus for portraiture with acetylene.—One ordinary circular splash bath was fixed upon a stout bar of iron and made to raise or lower by a clamp at the back. Then a piece of tin was fastened round the rim of the bath, so making it deeper, as it were, and also concentrating the light more upon the sitter. Then acetylene burners were placed in the bath in rows as follows:—Top row, four; second row, ten; third row, ten; fourth row, five, and these were made to turn up or down altogether by a lever at the side. There was also one burner in the centre on a separate tap, by which to focus.

The whole of the apparatus was enamelled white. The gas was generated upon a lawn about twenty yards from the room, and carried up through the window in an ordinary garden hose pipe.

By the use of a large mirror as a reflector to lessen the shadows, excellent exposures were secured at five seconds, using a Barnet



extra rapid plate and a Voigtlander's euryscope (portrait) lens, worked at *f*/22.—"B.J.," September 1, 1905, p. 699.

FLASHLIGHT.

Flash Powders.—The Chemische Fabrik Griesheim-Elektron, Frankfort-on-Maine, makers of pure magnesium powder, ribbon, etc., recommend flash powders as follows:—(1) A quick-burning powder (Gaedicke and Miethe)—of magnesium powder, 30 parts; potassium chlorate, 60 parts; antimony sulphide, 10 parts. (2) A safer powder (Galewsky)—of potass perchlorate, 69 parts; magnesium powder, 48 parts. These are kept in well stoppered bottles, and a little potassium chlorate mixed with 1/10 weight of milk sugar dusted over just before ignition. (3) Non-smoking powder (Kessler)—of potass persulphate, 2 parts; magnesium powder, 2 parts; and (4) magnesium powder, 1 part; ammonium nitrate, 1 part (Rainer).

The C.F.G.E. marks its powders with the number of the standard sieve through which it will just pass. Thus "70 powder" corresponds to a No. 70 brass-wire sieve of 670 meshes per sq. cm. "80" is a sieve of 876 meshes per cm. Thus the larger the number, the finer the powder. A powder of 70 is chiefly used for flashlight work, and is denoted as "F powder."—"Phot. Indus.," November 23, 1904, p. 1075.

The Actien Gesellschaft für Anilin Fabrikation have obtained a German Patent for producing highly actinic flashlight mixtures with little evolution of smoke, by means of mixtures of aluminium or magnesium powders with the nitrates of rare earths, such as thorium, cerium and zirconium; for example, equal weights of finely-powdered thorium nitrate and magnesium burn about three times as quickly as a mixture of magnesium

and black oxide of manganese in equal weights.—Ger. Pat., No. 158,215, May 30, 1903.

Dr. Krebs prepares flash powders as follows:—*Formula*: 1. Flash powder.—Magnesium, 10 parts (or magnesium, 2 parts; aluminium, 2 parts); chrome alum, 10 parts. For "time" powder.—Magnesium, 100 parts (or magnesium, 80 parts; aluminium, 20 parts); chrome alum or copper sulphate, 100 parts; lime oxide, carbonate, or glass, 20 parts.—Eng. Pat., No. 27,267, 1904.

Other powders patented by Dr. Krebs consist of mixtures of metallic aluminium or magnesium (or both) with silicic acid, boric acid, nitrates of alkali, and alkali earth metals; with amorphous phosphorus or silica for quicker combustion, and with carbonates of alkali or alkaline earths, silicic acid, etc., for slower combustion. By the additions of oxides and carbonates of the alkalies or alkaline earths respectively, the amorphous phosphorus and the nitrates may be prevented from burning with the evolution of a large quantity of smoke which contains phosphorus acid and phosphoretted hydrogen, which are injurious to health. The addition of suitable oxides and carbonates prevents the development of smoke and of noxious fumes. Typical powders:—1. Flash: Magnesium, 100 parts (or half of which may be replaced by aluminium); alkaline nitrate, 200 parts; amorphous phosphorus, 5 parts; magnesium silicate, or carbonate, glass powder, or the like, 5 parts. The lights may be coloured by additions of certain salts.—Eng. Pat., No. 27,268, 1904.

Hans Lükkte, Paul Arndt, and Ernest Leopold Löwengard, patent mixtures of magnesium or aluminium, with compounds of the heavy metals, which can act as carriers of oxygen. Suitable compounds for this purpose are oxides, carbonates, and sulphates of iron, lead, and copper, alone or in combination. A typical formula is:—Magnesium, 100 parts; aluminium, 50 parts; oxide of iron, 30 parts; copper carbonate, 20 parts; magnesium sulphate, 5 parts.—Eng. Pat., No. 27,465, 1904; "B.J.," February 17, 1905, p. 131.

Hans Lükkte, Paul Arndt, and Ernest Leopold Löwengard patent a flashlight cartridge, in which the case is of aluminium or copper-coated aluminium from .1 to .3 mm. thickness, which metal in burning produces a light of great intensity.—Eng. Pat., No. 27,466, 1904.

Orthochromatic Flashlights.—Dr. G. Krebs has taken out a patent for non-explosive flashlights with which the use of the usual yellow, blue, green, or red filters should be made unnecessary for orthrochromatic or trichromatic work. The substances used are mixtures of magnesium or aluminium, with silica, boron, nitrates of the alkalies, alkaline earths, the rare earths, metallic nitrates and amorphous phosphorus. Copper, zinc, lithium, strontium, barium, soda, calcium, caesium, rubidium, thallium, iridium, or other metals or their salts or other substances are added, so that the colours of objects are correctly reproduced on ortho- or pan-chromatic plates.—Eng. Pat., No. 27,267, 1904.

Also under "Flashlight" in Section III.

III.—PHOTOGRAPHING VARIOUS SUBJECTS.

Portraiture.

Portraiture with Yellow Screen.—For the correct rendering of flesh tones and golden hair, E. J. Wall recommends a screen made as follows, and used in conjunction with an iso plate:—

A.	Tartrazine	$\frac{1}{2}$ grain
	Distilled water	1 ounce
B.	Gelatine	30 grains
	Distilled water	1 ounce

The gelatine must be soaked in the water for one hour, and then dissolved by the aid of heat. The screen is made by flowing 117 minims of a mixture of:—

Solution B...	1 ounce
Solution A	20 minims

on to a sheet of thin flawless glass 4 by 4 inches.

This screen permits of a comparatively short exposure in the studio.—"P. N." March 31, 1905.

Figure Studies with Telephoto Lenses.—Leclerc de Pulligny discusses the advantages of the telephoto principle in large work direct, as it is practicable to take a more distant view point, and a camera of moderate extension can be used. He suggests a telephoto combination having as positive a large aperture anachromatic symmetrical lens, a portrait lens, an anastigmat or demi-anachromatic ("Rev. Phot.," October, 1904). Any one of these can be combined with a corrected or with an uncorrected negative. The changes rung on these combinations will permit of any degree of diffusion. If uncorrected lenses are used, a correction will be necessary, after focussing, in two movements: (1) Withdraw the front lens from the negative attachment, and (2) move the ground glass towards the lens. Depth of focus enables one to neglect the second of these movements. The amount of movement for the first adjustment is given by the formula: $\epsilon f_1 - \epsilon f_2 + (\epsilon + \epsilon^1)\,\Delta$, where ϵ is the coefficient of chromatic aberration of the front lens, f_1 the focal length of the front lens for yellow light, ϵ^1, coefficient of chromatic aberration of the negative lens, f_2 the focal length of the negative lens for yellow light, and Δ the optical interval of the system, *i.e.*, the separation between the two posterior foci (for the yellow light) of the two components after focussing. In practice the correction is simplified by the fact that the quantity $(\epsilon + \epsilon^1)\,\Delta$ varies very little under conditions of portraiture, and can be replaced by its mean value. Thus $\epsilon f_1 - \epsilon f_2 + (\epsilon + \epsilon^1)\,\Delta$ is a constant, *i.e.*, the amount of movement is the same in every case. It may be negative in some cases and the

lenses must be separated instead of approached. This is so when $\epsilon = 0$, as when an anastigmat is used as front lens.—"Rev. Phot," December 1904, p. 366.

Candlelight Effects.—Newton Gibson employs a magnesium lamp, consisting of a lath or rod with its face covered with black velvet, and a triangular chimney of tin fixed to the back, at the lower extremity of which a strip of magnesium is fixed. The complete lath is used as (1) the source of light—by burning the magnesium—and (2) a mask for the candle included in the composition, *i.e.*, the candle is placed so that there is a blank and dark space behind it. The exposure is made by lowering the magnesium attached to the lath on to the candle flame, and when it has been consumed the rod is raised for a moment to impress the candle on the plate. It is essential to make the exposure in a room lighted to some considerable extent by daylight, *e.g.*, an ordinary sitting-room. The general illumination secures detail and roundness, and the magnesium gives the strong effect.—"Pgm.," November, 1904, p. 288.

Portraiture with Pulligny's Anachromatic Lenses.—See "Lenses."

Corpses.—Bertillon proposes to impart the appearance of life to corpses photographed for identification by injecting glycerine into the eyes with a syringe.—"B.J.," November 4, 1904, p. 942.

Groups.—For preparing a key of a large group the plan is suggested of providing each person with a ticket, bearing a boldly printed number, and a request that the person write his name on the back of the card. After the usual exposure, the members of the group are requested to display the numbered side of the cards, and a second plate exposed. From the negative so obtained each person can be identified on reference to the cards, which are collected on the group breaking up.—"B.J.," July 21, 1905, p. 561.

Portraiture is the subject of "Pract. Phot.," No. 21, April, 1905.

Figure Studies, Groups and Genie, are treated in "Pract. Phot.," No. 23, June, 1905.

Landscape, etc.

Night Photography.—Ellis Kelsey, writing on the Grün lens for outdoor work by artificial light, finds that an $f/2.5$ lens has good depth of focus at the centre of the field, but that definition falls away considerably towards the edges, and that there is a good deal of flare, especially with a small stop. Exposures at $f/2.5$ on Ilford "Monarch" plates, on such subjects as a well-lighted theatre scene, or a figure near a street arc lamp, were found to be complete failures at 1/10th of a second, and required at least three or four seconds. By arranging a subject concavely before the lens, it is possible to obtain good definition all over the plate with the Grün lens.—"Pgm.," August, 1905, p. 219.

Theatrical Photography.—Hauberisser remarks that scenes may be taken during performances, if lenses of larger aperture and orthochromatic plates, with high yellow sensitiveness are used, even by the light of the ordinary incandescent light.—"Lechner's Mitt.," 1904, p. 296.

Breaking Waves.—F. J. Mortimer, in a lecture before the Royal Photographic Society, describes his methods of photographing marine subjects and breaking waves. A costume of oilskins and sea-boots is necessary, and the photographer gets as near to the subject of possible. Exposure is made when the mass of water is at its greatest height, and over-exposure must be guarded against. The ordinary R.R. lens stopped down to *f*/11 or *f*/16 is usually good enough, and with a rapid plate—about 200 H. and D.—exposures in early spring vary from 1/80 to 1/150 second. A focal-plane shutte is ecommended, and a gey sunless day gives the finest effects. Half-plate is large enough for the work, and the camera should be used in the hand. The camera must be enclosed in oilskins, and the front of the lens protected from flying spray. Development of the negatives must be show and in a weak developer..—"B.J.," May 19, 1905, p. 389-9.

Marine Photography occupies, in the shape of various articles and notes, "Pract. Phot.," No. 24, July, 1905.

Marine and Surf Photography, by F. J. Mortimer and Jas. H. MacCorkle, is the special subject of "P.M.," No. 71, August, 1905.

Botanical Photography.—For the photography of growing plants and flowers F. Martin Duncan recommends a well-built stand camera with long bellows extension, swing back, and rising front. The lens should be of fairly long focus, and preferably of the convertible double anastigmat type. A short three-fold tripod with broad head is necessary, and it should be capable of being placed within 12 or 14 inches of the ground for photographing low-growing plants. Orthochromatic plates must always be used, and, where possible, in conjunction with a suitable screen. For field work a grey canvas background, mounted on two fairly sharp pointed sticks, is a useful adjunct, not only as a background, but frequently as a wind shield, enabling the photographer to use a smaller stop and fuller exposure.—"A.P.," July 11, 1905, p. 33.

Flowers.—A number of hints on flower photography includes the suggestion of a simple device for arranging flowers, when only the blooms themselves, and not the containing vessel, are to be shown. A wide-mouthed bowl or basin is covered with a layer of clean sand at the bottom, to the depth of half an inch or so, and a cover of wire-netting, of about half-inch mesh, bent over the top. The sand is covered with cold water, and the position of the flowers can thus be adjusted to a nicety.—"Pgm.," July, 1905, p. 205.

Floral Photography is the subject to which "Pract. Phot.," No. 19, March, 1905, is devoted.

Cloud Photography.—F. Wood shows how clouds and landscapes can be obtained with one exposure on one plate with the aid of (1) sky shades, (2) foreground shutters, (3) ortho plates and screens, (4) assisting the sky in development, and (5) shading during printing. He also describes the making of cloud negatives, and methods of printing them in conjunction with landscapes, etc. For carbon prints he advises the landscape to be printed, developed, alumed, washed, and dried. A print from

the cloud negative is then made without any masking at all. This is squeegeed down on the face of the print, stripped, and developed. A camel-hair brush can now be used to remove the whole of the cloud image where not wanted, leaving the landscape undisturbed beneath. If not successful a rub with the hand or brush will remove all the clouds without hurting the landscape, and a new start can be made.—"Phot.," April 25, 1905, p. 405; May 2, 1905, p. 428.

Lightning Flash Photography.—John Stabb recommends a hand-camera for this work, as there is then no difficulty in following the course of the storm. Focus for infinity, and when a storm commences watch the position where the most frequent discharges take place. Turn the camera toward this point, and have the lens uncapped and plate in position. Use stop $f/11$. Keep lens uncovered until flash has occurred, when it should be capped and a fresh plate inserted. If the same plate is used for succeeding flash, fog is apt to occur. Development should be continued until plate is fairly dense to transmitted light, as the flash is there, though it cannot be seen frequently until after fixation. Good prints of lightning flashes are always very acceptable by the Meteorological Society, Victoria Street, London. —"P.N.," April 28, 1905.

Winter Subjects are treated in the "Pract. Phot." for November, 1904, No. 15.

Animal Photography is the subject of "Pract. Phot." for January, 1905, No. 17.

Flashlight.

Estimating Magnesium.—Orostini gives the following table of the quantity of magnesium and stop to be used for taking objects by magnesium:—

Distance of Object from Light.	Quantity of Magnesium in grammes.				
	F7.	F9.	F12.	F18.	F25.
1 metre	0.07	0.01	0.2	0.4	0.8
2 ,, ...	0.28	0.04	0.8	1.6	3 2
3 ,, ...	0.63	0.09	1.8	3.6	7.2
4 ,, ...	1.21	1.06	3.2	6.4	12.8

—"Der Am. Phot.," January, 1905.

Magnesium for Underground Work.—Martel, who has done a great deal of subterranean photography, says that magnesium is alone suitable, aluminium and zinc being less actinic. He divides the subjects into two classes: (1) of short distances from 15 to 20 metres, and (2) of long distances from 15 to 60 metres. For the shorter distances he uses three or four strips of magnesium

ribbon, 3 mm. broad, and 0.5 m. long, wound into a spiral torch, which gives an exposure of from $1\frac{1}{2}$ to 3 minutes; from three to six of these spirals will give exposures of from 15 to 20 minutes, which is enough up to 15 metres, up to 10 metres one spiral is enough. Placing magnesium powder in 5 gramme lots, and firing with a little tuft of gun cotton, one charge will be sufficient up to 10 metres, for greater distances successive charges should be fired. Flash powders are not so satisfactory: they cause more smoke, and are more dangerous. For the longer distance work he prefers the blow through lamps, using about 8 grammes of plain magnesium powder, up to 60 metres; up to 40 metres 5 grammes.—"Ann. Gen. de Phot.," 1905, p. 411.

Flashlight Powders.—A. Londe has published a useful work on the use of magnesium ("La Photographie à l'Eclair Magnesique") in which he gives the following facts about flash-light powders:—

According to M. Londe, it is somewhat generally assumed that the duration of a flash is very short, varying from 1-50th to 1-80th, or even 1-125th of a second. To prove the actual duration he used the well-known method of a revolving plate, and the light reflected from a mirror attached to one arm of a tuning-fork, the whole being electrically controlled, and on development the sinusoidal curve on the plate was measured and the duration of the flash calculated. Eleven powders were tested, one gramme of each being fired, and the longest exposure was found to be 1.5th of a second and the shortest 1-30th.

The duration of the flash is dependent on various factors; but, calling the unknown ingredients of a flash-powder X, the following little table is instructive:—

			Duration of Flash.
1.	X	100	0.07 sec.
	Magnesium	150	
2.	X	100	0.10 „
	Magnesium	175	
3.	X	100	0.11 „
	Magnesium	225	
4.	X	100	0.12 „
	Magnesium	250 ... much above	

Another instructive experiment was the firing of a freshly made powder and one that was old:—

	Duration.	Delay.
Fresh powder...	0.03 sec.	None.
Old powder	0.15 „	0.06 sec.

The term "delay" means the interval between the application of the fire and the flash.

The weight of the charge must obviously play a part in the duration of the flash, and the following table shows it:—

	Duration.
1 gm.	0.03 sec.
2 gms.	0.05 „
3	0.07 „

The particular manner in which the charge is laid also plays a part; thus:—

	Duration.
1 gm. in a heap	0.2 sec.
„ spread out	0.4 „

The method of firing affects the duration:—

	Duration.
Electric	0.14 sec.
Percussion cap	0.144 „
Match	0.188 „
Touch-paper	0.280 „

The author also finds that any flash of longer duration than 0.12 sec. will show movement of the eye; and that aluminium powders are five times less actinic than magnesium.—"B.J.," March 31, 1905, p. 245.

Copying.

Enclosed Arcs and Bluish Originals.—In making negatives of bluish wash drawings with the enclosed arc-lamps, it is often found that the reproduction is very flat, as compared with the original. This is probably due to the fact that the light blues reflect nearly as much ultra-violet as the whites, and the result is a loss of tone. The exposures with this kind of original are usually so short that it is no great sacrifice to cut out some of the ultra-violet.

A filter should be used of quinine sulphate, 1 part; water, 100 parts, solution being effected by the addition of a drop or two of sulphuric acid; or a filter of bichromate of potassium, 1 part, in water, 10,000 parts, will also cut out the ultra-violet. These solutions are used in a cell of 10 millimetres thickness. If the bichromate filter is made stronger, it begins to cut out the violet and the blue, and exposures become so long as to make the use of wet collodion impracticable. Either of the above weak filters may, however, be used with ordinary wet plates without very seriously prolonging exposure.—"B.J.," April, 1905, p. 269.

Coloured Screens for Copying.—The use of coloured screens for copying prints is recommended, and preferably in the form of liquid cells. Three solutions only are required, tartrazine for yellow, brilliant acid green, and eosine. The yellow filter will be useful for copying blue carbon prints on a white or yellow paper, and with black or brown pigments on yellow paper it gives better contrasts. The green filter, more or less dilute, is used for red or reddish-brown prints on yellow paper, and is especially useful for uranium toned prints. The red screen will be rarely needed, and only when bright blue prints are to be copied.—"Zeit. für Repro.," April, 1905, p. 53.

Copying by Artificial Light.—T. Kingham describes his method of copying engravings by artificial light. Using Welsbach burners fixed to front of camera, level with lens and about 4 inches in front, an exposure of two minutes with stop $f/16$ and

medium speed iso plate, gave good results. With ordinary duplex paraffin lamps, twenty minutes at $f/11$ gave good copies same size. Colour screens unnecessary with lamplight, as light itself is yellow.

With magnesium ribbon the plan adopted was to burn a measured length first on one side of the lens, and then the same quantity on the other. In all copying by artificial light the points to remember are:—

(1.) Light equally from both sides to avoid grain in copy.

(2.) Have the light as near lens as possible.

(3.) See that no light can shine directly into the lens, which should be fitted with a hood.—"Phot.," April 18, 1905, p. 385.

Stereoscopic Photography.

Stereoscopic Vision.—Ch. Aerts discusses the parts played by the unconscious training of the eye, apart from physiological phenomena in the sensation of relief. He finds that two views taken vertically, one above the other, the vertical separation being equal to the horizontal separation of the eyes, show stereoscopic relief when viewed in the ordinary way.—"Bull. Soc. Fr. Phot.," November 15, 1904, p. 526.

C. W. S. Crawley, in a paper before the Optical Convention, gives tests on various people showing the delicacy of human stereoscopic vision and its application to range-finders.—"B.J.," June 9, 1905, p. 446.

Pseudo-Stereographs.—Under the name "Stereofactor," A. Lockett describes a simple instrument by which a certain stereoscopic relief can be obtained on viewing two prints from the same negative. It consists of a pair of metal grooves, fixed at an angle to each thereof about 140 degrees, with, in the centre, a pair of upright springs, forming a clip to hold the slide. This latter is made from two prints from the same negative. Each print is first made exactly the same size, and one-eighth of an inch is then cut off the right-hand side of the right picture, and a similar strip from the left-hand side of the left picture. They are then mounted one-eighth of an inch apart, and exactly level. This slide is bent to go into the grooves of the stereofactor and examined in an ordinary stereoscope.—"B.J.," December 23, 1904, p. 1085.

Immaterial Solids.—Chas. E. Benham obtains stereoscopic prints of three-dimensional harmonic curves by photographing a silvered bead caused to vibrate by bent clock spring. He discusses the results in their bearings on conceptions of four-dimensional space.—"Pgm.," February, 1905, p. 45.

Tele-Stereoscopy.—Paul Heilbronner obtains stereoscopic prints of very distant subjects by making two telephoto negatives from separate exposing stations, the distance between which is measured along a line at right angles to the line of vision. Apart from the use of this method in landscape stereoscopic photography, the distance of a distant object can be computed from the formula :—$\rho \frac{DEF}{= EF -} D\alpha$ Where ρ is the distance required (that of the object from the camera), F the focal length of the telephoto, α

the difference of the distances between the verticals of two points (known and unknown) on the photographic proofs, and E the separation of the two stations along a line perpendicular to the axis of vision.—"Compt. Rend.," December 5, 1905, p. 968.

Swinging Lens Stereo Outfit.—René d'Héliécourt devises a type of stereoscopic camera in which the lenses are a fixed distance apart, but are pivoted on a vertical axis so that the two optical axes can be inclined to each other in the horizontal plane.

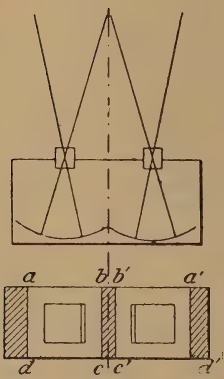


Fig. 1—Distant objects : lens-axes parallel.

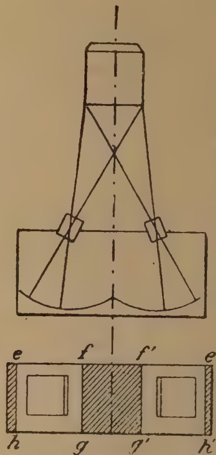


Fig. 2.—Near objects : axe inclined.

The inclination is adjustable to suit the distance of an object, and even definition is obtained by using a curved sensitive surface (roll-film). The conditions, it is claimed, correspond to those of the human eye.—"Phot Rev.," December 18, 1904, p. 196.

A New Projection Stereoscope.—Metz has devised a modification of Brewster's prismatic stereoscope, which enables projected stereoscopic pictures to be seen stereoscopically. It consists of a rectangular box 12 × 6 × 5 cm., on the narrow base of which are placed two prisms, with their edges towards one another, as shown in the Fig. 1. These prisms are held close to the eyes, and are so arranged that they are the distance of the eyes apart, and parallel vision is obtained. Opposite the prisms are two apertures 15 × 15 mm., and are separated so that each eye can only see one picture. The transparencies should measure 6 × 9 cm., and with a lens of 300 mm. focus, and a distance of 6 metres, the projected image will be 1 m. They must be placed close to one another,

so that the condenser, which should have a diameter of 21 cm., can cover them. Perfect stereoscopic effect is obtained by observing the projected images through this instrument, and it may also be used for examining prints in the ordinary way. The effect of much greater enlargement can be obtained by using this

Fig. 1.

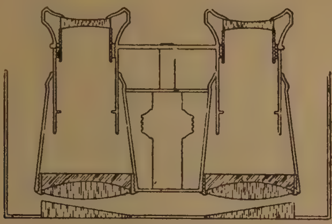
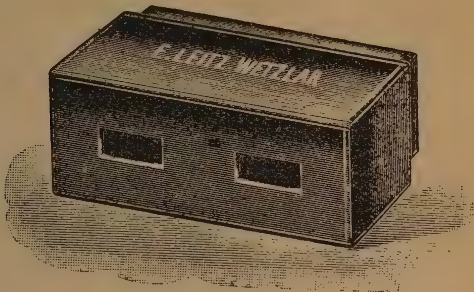


Fig. 2.



Fig, 3.

instrument with an opera glass, as shown in Fig. 2. The advantages of this system are that one lamp, one condenser, and one projection lens only are required, and the apparatus itself is cheap.—"Eder's Jahrbuch," 1905, p. 115.

Léon Pigeon has designed a stereoscope serving for prints made at a very wide angle of view. It consists of two panels, right and left, forming a solid angle of, say, 140 degrees. An intermediate plate or panel, bisecting the angle, carries a small flat mirror or

total-reflection prism. The ordinary (unreversed) right-hand print is placed on the right-hand panel, and is viewed directly by the eye of the observer. A reversed left-hand print is mounted on the left-hand panel, and is seen unreversed by the left eye by means of the mirror. The apparatus thus produces the effect of a left-hand print superimposed on that on the right, but observable only by the left eye, the essential condition for stereoscopic effect.—"Compt. Rend.," July 24, 1905, p. 247.

STEREOSCOPIC PROJECTION.

Stereoscopic Projection by Cinematograph.—Theodore Brown causes the camera to oscillate so that the axis of the lens, produced, forms the radii of a circle, of which an object in the middle plane of the subject is the centre. The positive film is projected in the usual way.—"Opt.," December 30, 1904, p. 434, and January 13, 1905, p. 479.

A. Goderus discusses and disputes the theory of Theodore Brown ("Phot.," July 23, 1904).—"Bull. Belge Phot.," November, 1904, p. 519.

A system of stereoscopic projection, depending upon the use of three separate bands of film in the stage of the lantern, is described by Theodore Brown. Observers require no special instruments, and the effect on the screen appears to be due to differences in the rate of motion of the films and in the tone values of the three positives.—"Opt.," August 11, 1905, p. 534.

Photo-Micrography.

Difficult Subjects.—L. Mathet obtains detail in photographing microscopic objects of high refractive index by placing them against a partially dark background. This is done by inserting a disc before the condenser to cut out the central rays, so that the illumination is by the oblique rays. In preference to an opaque diaphragm for this purpose, a coloured one is chosen for use in conjunction with an orthochromatic plate.

In the case of objects highly stained with an actinic colour, plates are chosen feebly sensitive to the colour of the object, and are exposed behind a screen which intercepts rays of this same colour. Thus, a preparation highly stained violet by hæmatoxyline, or blue by methylene blue, is exposed on a Lumière A plate (yellow sensitive) behind a yellow screen.

In the case of opaque or strongly stained objects of non-actinic colour, a long exposure is necessary on a plate sensitive to the particular colour of the object, and avoiding any screening of the same colours by a filter. If deeply-coloured non-actinic and lighter actinic parts occur in the same object, it is often advisable to use a screen of the colour of the lighter tints, giving considerably more exposure than usual.

For thick objects, where definition is wanted in several planes, it is best to use objectives of small numerical aperture, *e.g.*, the

Planar, but the aperture of an ordinary micro-objective can be reduced by fitting an iris-diaphragm adapter to the tube, the largest aperture of which will pass the rays from any lens which may be used. By opening or closing the diaphragm, the different planes can be brought into focus. But for many objects, the "successive exposure" method must be used (Mathet's "Traités de Photomicrographie").—"Revue des S. Phot.," November, 1904, p. 231.

Indicating Measurements on Photo-Micrographs.—Thomas C. Hughes takes the negative of an object under the microscope in the usual way, and then inserts in the stage a micrometer (divided into fractions of an inch or millimetres) so as to get the same magnification on the focussing screen as when the plate was exposed. The magnified scale of the micrometer is set off with a pair of spring dividers with sharp points, and marked along the edge of the negative after drying. By marking the distance along each edge of the negative the photomicrograph is charted into squares, each side of which is, say, 1-1000th inch, or .25 mm. If, when scoring the negative in this way, the film be slightly damped and a blunt stylus be used, a ridge of gelatine will be heaped up on each side of the line, so that in the print the line will show not only as black in the light portions, but as light in the darker portions. —"B.J.," July 28, 1905, p. 584.

Quartz Objectives.—Dr. von Rohr has calculated, and the firm of Zeiss have manufactured, microscope objectives and condensers of the new fused quartz, which are not corrected, and are called "monochromatic" as they are used with ultra-violet light of the wave length 275 μ. Focussing is effected by means of a fluorescent plate. Köhler, who has been working with this objective and light, finds that many substances fluoresce and that they can then be observed with an ordinary ocular.—"Phot. Korr.," January, 1905, p. 28.

Microphotographic Apparatus for Ultra-Violet Light.—A. Köhler, of Jera, describes the apparatus constructed by Carl Zeiss, in which greater resolving power is obtainable with ultra-violet light from sparks of a Leyden jar passing between cadmium or mercury electrodes.—"Opt.," January 27, 1905, p. 523.

Focal Measurements.—Commandant V. Legros concludes a series of chapters on focimetry with that for microscopic optics. —"Revue des S. Phot.," November, 1904, p. 235.

On the preparation and etching of metals for photo-micrography, and on photo-micrographic methods for detecting impurities in iron and steel.—J. E. Stead, "Journ. Roy. Micr. Soc.," June, 1905, p. 273.

Pinhole Photography.

Pinhole Exposures.—Alfred Watkins adopts a system of marking pinholes, which is based on a suggestion of Dr. d'Arcy Power,

which was in turn prompted by the method of Mr. Watkins, published in the "B.J. Almanac," 1893. Dr. Power's method of marking pinhole apertures so that it is easy to calculate exposures, is that of giving to each pinhole a number of such a magnitude, that when the camera extension is multiplied by it, the product may be used just as an *f*/ number is used, with any of the ordinary actinometers or exposure meter tables, but with this important difference—that the exposure given by the actinometer in seconds is reckoned as minutes.

Mr. Watkins finds it advisable to depart from the theoretical standard. If a plate, exposed with a lens and an ordinary diaphragm, is exposed by calculation, in most cases the pinhole exposure will be rather under-exposed in comparison with the other. It seems best to expose a pinhole for 50 per cent. longer than the calculated exposure. It saves much trouble to make this allowance in calculating the table. Therefore, in the simplified table, 1/40 is taken as standard instead of 1/60th inch. This works out at .158, but to attain simple decimals, is taken as .160.

It is proposed to call the numbers the Watkins-Power, or, in short, W.P. Nos.

PINHOLE TABLE.

W.P. No.	Decimals of Inch.	Nearest vulgar fraction.	Nearest needle size.	Good working distance.
1	.160	$\frac{1}{7}$	—	—
2	.080	$\frac{1}{13}$	—	—
3	.053	$\frac{1}{19}$	1	40 inch.
4	040	$\frac{1}{25}$	4	20 ,,
5	.032	$\frac{1}{31}$	5	14 ,,
6	.027	$\frac{1}{38}$	7	10 ,,
7	.023	$\frac{1}{44}$	8	8 ,,
8	.020	$\frac{1}{52}$	10	5 ,,

Rule for Use.—Multiply the W.P. No. of aperture by its working distance from plate. Use the result as the *f*/ No. with which to calculate the exposure by meter tables or other means. Whatever the calculated result is in seconds or fraction of a second, expose that same number of minutes or fraction of a minute.

Example.—W.P. 6 at 8 inches, calculate as *f*/48.—"Phot. Journ.," May, 1905, p. 177.

Telephotography with a Pinhole.—Dr. H. D'Arcy Power employs a negative lens behind a pinhole in order to reduce the size of the camera when taking large pinhole landscape negatives direct. Negative lenses of 10, 16, or 20 diopters are placed an inch or two behind the hole. They should be in a sliding mount of short barrel so that the distance from lens to pinhole can be adjusted from about two inches to approximate contact.—"Pgm.," January, 1905, p. 25.

J. H. Noble deals with the subject of pinhole work generally.

If the exposure for a lens working at $f/8$ is known, the proper exposure for any pinhole and any plate distance can be calculated from following table:—

DISTANCE OF THE PLATE FROM THE PINHOLE.

No. of Ndle	1in.	2in.	3in.	4in.	5 in.	6 in	7in.	8in.	9in.	10in.
8	29	118	265	471	725	1060	1442	1884	2385	2944
10	54	216	486	864	1350	1944	2646	3456	4374	5400
11	69	277	624	1109	1733	2496	3397	4436	5616	6932
12	92	369	831	1477	2308	3324	4529	5908	7579	9232

To use the table, first determine what exposure is necessary with a lens at $f/8$. Then multiply that time by the factor in the table standing opposite the size of hole used and in the column representing the plate distance.—"Photo-Era," December, 1904.

[The method is obviously much more cumbrous in use than the Watkins-Power system given above.—ED., "B.J.A."]

"Advanced Pinhole Photography," by H. D'Arcy Power, is the title of "P.M.," No. 70, July, 1905, which deals with the author's experience in this branch of photography.

IV.—THE NEGATIVE.

Wet Collodion and Collodion Emulsion.

In Hot Climates.—Major-General Waterhouse gives the following precautions needed in working in hot climates:—Silver bath not too strong, about 7 per cent., and acid enough, with nitric acid to prevent fog. It must not accumulate iodine, which it soon does if it falls below strength. It must be frequently sunned. Equal parts of ether and alcohol are used in making the collodion. In hot weather the plates are packed in the slides with wet blotting-paper. The developer is the acid iron with a large proportion of alcohol and acetic acid, about $2\frac{3}{4}$ per cent. of each and 5 per cent. ferrous sulphate.—"B.J.," February 17, 1905, p. 129.

Reducing Line Wet-Plate Negatives.—Instead of the expensive iodine-cyanide reducer, the following can be used with equally good results:—A little 10 per cent. potass ferricyanide solution is added to the cyanide solution. The strength should not be greater than about 1 per cent. if the usual commercial good 30 per cent. cyanide cake be used. A formula is:—1 per cent.

cyanide solution, 4oz.; 10 per cent. potass ferricyanide solution, ½ oz.

Another method of reducing wet plates is to flow over the negative some copper bromide intensifying solution diluted to half strength, wash, and afterwards flow with weak cyanide solution. This needs care, but by this method a lead intensified negative can be reduced.—"B.J.," January 27, 1905, p. 71.

Collodions for Copying Coloured Originals. Dr. C. Sturenburg. See under "Orthochromatics."

The Gelatine-Bromide Process.

An illustrated description of dry plate and paper manufacture, as carried out in the works of Jougla et Cie, appears in "Phot. Fr.," October and November, 1904.

PACKING OF PLATES AND PAPER.

Charles Gravier notes, as the result of using plates by Lumière and Monckhoven seven to eight years old, that the orthochromatic brands kept better than the ordinary. The best wrapping for sensitive papers appears to be two sheets of card wrapped in porcelain paper.—"Bull. Soc. Fr. Phot.," December 15, 1904, p. 581.

As a wrapping material Dr. Miethe suggests paper saturated with a solution of shellac in borax, which, it is claimed, effectually obviates any chemical action of chlorine, hydrogen peroxide, or acids in the paper. The solution of the shellac can be applied with a brush by machinery.—Ger. Pat., No. 155,178, March 18, 1903; "B.J.," November 11, 1904, p. 962.

S. T. Harris takes large sheets of thin glazed cardboard, about two-sheet thickness, and coats them with thin solution of brown shellac in spirit. When dry they are rubbed free of adhering particles which might abrade the film, and cut up to size. They are used as separating material between plates.—"B.J.," November 25, 1904, p. 1018.

BACKINGS.

E. Höfinghoff places a phosphorescent card behind the plate in the dark slide, and claims to obtain action on the plate by reflection with improved orthochromatic effect.—Ger. Pat., No. 156,045, March 8, 1904.

Prevention of Halation.—To deal with strong contrasts prevent halation, control gradations, etc., Newton Gibson directs:—"First expose a plate which gives clear glass for the shadows with the glass side towards the lens, giving a very short exposure for the lights only. Develop, fix, and dry, then put back again into the dark slide to the same place as before with another (unexposed) plate, film sides together, and give a full exposure for the shadows. If the first negative be of the right density the second will develop in beautiful gradation, and with a good stereoscopic effect." The precautions necessary in carrying out this method are detailed at some length in an editorial.—"Pgm.," April, 1905, p. 100.

Emulsions.

Mercuric Iodide Emulsions.—Lüppo Cramer finds that an emulsion of mercuric iodide in gum is very much more sensitive to light than a gelatine mercuric iodide emulsion. In the former case the mercuric iodide is obtained in the red form, in the latter in the yellow. A gum arabic silver iodide emulsion is similarly found to be 60 to 100 times more sensitive to light than a gelatine silver iodide one, and the grains of the former emulsion are much coarser than those of the gelatine emulsion. Ripening at 50 degrees C. for some hours does not lessen the difference in sensitiveness. On the other hand, a gelatine silver bromide emulsion is four or five times more sensitive to light than a gum silver bromide emulsion, but a gum silver chloride emulsion is two to three times more sensitive than a gelatine emulsion. Casein silver iodide emulsions are about 1-200th as sensitive as gelatine silver iodide. Mercurous iodide, when emulsified in gelatine, is three to four times more sensitive than when emulsified in gum.—"Phot. Korr.," January, 1905, p. 13.

On the dynamics of development, including the microscopy of the image. S. E. Sheppard and C. E. K. Mees.—"Proc. Roy. Soc.," Series A, Vol. LXXVI., No. A 509, p. 217.

A Vehicle for Emulsion.—J. H. P. Gillard and H. H. Molyneux have patented a new vehicle for sensitive silver and other preparations to be used in the place of gelatine for gaslight paper, printing-out, and self-toning papers, etc. A mucilage of bassora, tragacanth, marsh mallow root, linseed, seeds of the plantain or plantago psyllium, quince seeds, is combined with a solution of agar-agar. In this combination the setting or gelatinising properties of agar-agar are combined with the special plastic qualities of the bassorine or bassorine-like mucilage, the resulting product being a medium, vehicle, or coating composition which is soft and plastic, yet sufficiently insoluble, when dry.—Eng. Pat., No. 1,290, 1905.

EXPOSURE.

Short Exposure Numbers.—H. Cousin considers fractional expressions (1-25th second, etc.) for short exposures inconvenient, and suggests that a unit representing a very small fraction of a second should be chosen, and exposures expressed in multiples thereof, just as microscopists speak of diameters in terms of "microns" (thousandths of a millimetre). The terms "centi-second" (1-100th second), "milli-second" (1-1000th second), are proposed.—"Bull. Soc. Fr. Phot.," November 15, 1904, p. 531.

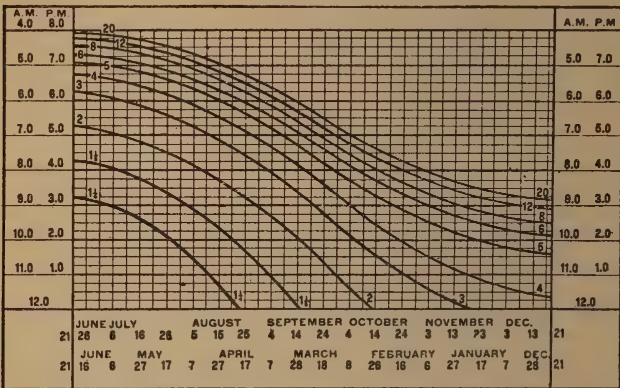
Daylight.—John Sebelien discusses "The Distribution of the Actinic Sunlight on the Northern Hemisphere at Summer Solstice." —"Phil. Mag.," March, 1905, p. 357.

Actinometric measurements on the summit of Mont Blanc. By M. A. Hansky.—"Compt. Rend.," February 13, 1905, p. 422.

"Zur Theorie der Extinktion des Lichtes in der Erdatmosphäre." By Dr. A. Bemporod (Mitteilungen der Grossh Sternwarte zu Heidelburg).—"Nature," February 23, 1905, p. 402.

Exposure.—H. W. Bennett discusses the subject of exposure with varying factors of lens, plate, stop, subject, etc. He calculates the exposures in following table from the fact that the value of daylight in clear weather varies in direct proportion to the height of the sun above the horizon.

Mid-day on the longest day of the year, June 21, is taken as the unit, and is represented by 1. This is the shortest exposure that can be given for any subject, and the curve marked 4, for example, shows the time and days when the minimum exposure becomes four times this amount, and the same with the other curves, the multiplying figure being marked on each. The horizontal lines represent the time, the heavy lines corresponding to the hours, and the finer lines quarter-hours. At three in the afternoon and nine in the morning the same exposure



is necessary. The vertical lines represent the date, the lines corresponding to every fifth day. The dates are marked under every alternate line to facilitate reference. The points where curve 4 crosses these lines indicate the times when four times the midsummer exposure must be given, and the same applies to each other curve. It will be seen, for example, that September 14 corresponds with March 28, as the exposures steadily lengthen from June to December, and then gradually shorten again in an equal ratio. As an example of the method of using this diagram, it may be assumed that an exposure of one second was given to a certain subject at one o'clock on a day in June; it will be seen by referring to the vertical line representing October 24, and the horizontal line indicating a quarter to three, that a corresponding exposure at that time would be five seconds.—"P.N.," January 6, 1905, pp. 5-6-7.

Speed Numbers.—T. Thorne Baker draws attention to the discrepancies existing between the plate speed numbers published

by different plate makers. He discusses the systems of H. and D., Watkins and Wynne, and arrives at the following table for comparing them:—

		H. and D.	
WATKINS.	WYNNE.	FER. OXALATE.	PYRO SODA
16	28	13	23 to 24
22	32	17 to 18	31
32	40	26	47
45	45	36	65
65	56	52	94
90	64	72	130
130	80	104	188
180	90	144	260
250	111	200	360
350	128	280	504

—"P.N.," August 25, 1905, p. 634.

Orthochromatic Processes.

SENSITISERS.

In testing the sensitising action of yellow dyes, T. Thorne Baker finds it best to work by Eder's method, *i.e.*, to make spectrograms with a standard artificial illuminant, and to resolve the ratio of density in the greenish yellow region to density in the blue region into a fraction, thus comparing the dye as to sensitiveness to blue and yellow. The following is a table of some results:—

Dye.	A. Density of blue region.	B Density of greenish yellow region.	Ratio A/B.
Aurantia ...	... 12 3	1.7	7.23 : 1
Thiazol yellow	... 14.5	3.7	3.92 : 1
Uranine ...	... 13.8	2.0	6.9 : 1
Auracine ...	... 13.8	4.0	3.45 : 1
None	... 9 3	1.9	4.9 : 1

Auracine is thus the best of the four dyes for sensitising for greenish yellow. The same four dyes were tested by preparing 1 in 1000 aqueous solutions, made alkaline with ammonia. Plates bathed in these were exposed under the Chapman Jones screen, and then all developed for the same time. The densities of the colour-patch records were measured and tabulated as follows:—

Dye.	Blue-violet square.	Green square.	Yellow square.	Red square.	
Auracine ...	... 27	14.5	1.0	1.75	(Densities)

The results with aurantia and uranine were not nearly as good as those with thiazol yellow and auracine, but uranine gave a slightly greater sensitiveness to bluish green. Auracine and aurantia were further tested by bathing plates with an ammoniacal

solution of each containing a little silver nitrate, which increased the action of the uranine, but was without action on the aurantia. Auracine may be of service as dye for green sensitising; like uranine, it is a far more valuable colouring matter when used with erythrosine, giving a continuous band from the blue-violet to about D½E on bathed plates. When using silver nitrate with auracine, thorough rinsing of the bathed plates is needed before drying them; the silver nitrate should about equal the dye in weight, and, lastly, the drying should be effected in two hours, and the plates used when fairly fresh.—"B.J.," December 16, 1904, p. 1066.

Homocol Sensitiser.—The Bayer Company issue instructions as follows:—Bathing solution: Homocol solution (1:1000), 1 to 2 parts; ammonia (sp. gr. .96), 5 parts; water, 100 parts. The plates, which should not be of the extra-rapid class, are first well dusted, and bathed in this solution for two minutes, using 50 centimetres for every 100 square centimetres of plate. They are washed for three minutes in running water, or in five changes, and dried in darkness at from 68 degrees to 78 degrees F., in not more than two hours. They can be dried with spirit with equal results as regards brilliance, but with lessened sensitising action of the dye. The rapidity of the plate is said to be unaltered by bathing.

Homocol.—A. J. Newton, C. E. K. Mees, and S. E. Sheppard, on examining the sensitising properties of homocol by Eder's method of yellow and blue screens, find the ratio of blue sensitiveness to yellow sensitiveness to be from 1.1 to 1.4, this value being unaffected by drying the plates (Ilford half-tone) with spirit after bathing. The following values for this ratio in the case of other plates are given:—

Erythrosine plates...	12 to 20
Good panchromatic plates	5 to 10
Plates with subdued blue sensitiveness (generally slow)	2 to 5

The same Ilford plates bathed in the following sensitisers, gave ratios as follows:—Pinachrome=1.1, homocol=1.1, pinaverdol=2.1, and the following figures are given for the ineitia of plates before and after bathing:—

Plate.	Inertia.		Ratio Unbathed Inertia.
	Bathed.	Unbathed.	Bathed.
Ilford half-tone	2.40	2.35	.98
Wratten speed...	.112	.174	1.55
Eastman extra rapid... ...	.192	.099	.518

The great differences in these results are probably due to the fact that the sensitiveness will depend upon the extent to which the dye is washed out.—"Phot. Journ.," July 15, 1905; "B.J.," July 21, 1905, p. 568.

Multi-film Ortho Plates.—A patent of the Sandell Films and Plates, Limited, specifies a multiple coated plate, consisting of two or more isochromatic emulsions. The dyes in liquid form are added to the emulsion, which is prepared in the usual manner previous to coating the support.—"Eng. Pat.," No. 9,246, 1905; "B.J.," August 11, 1905, p. 634.

Panchromatic Plates.—Professor Valenta gives his latest formula for the making of a panchromatic plate, with the aid of ethyl violet, first suggested by him for use with collodion emulsion. His first trials to sensitise gelatine plates with this dye were a failure, because he used too strong a bath; the tinctorial properties of ethyl violet, like all the other aniline violets, being very great. Finally, he found that bathing a dry plate with a 1:250,000 solution with a little ammonia for three or four minutes gave a strong band of sensitiveness extending from C to D, with a fainter band extending from D to E. This obviously gives a minimum about E, and to fill this up he now suggests the use of monobromofluorescine; and erythrosine to strengthen the yellow-green. He prepares a stock solution of :—

Ethyl violet solution (1:5,000)	100 parts
Erythrosine solution (1 : 500)...	20 ,,
Monobromofluorescine solution (1 : 500) ...	30 ,,

Fifteen parts of this are diluted with 500 parts of water and 2 parts of ammonia added. The plates should be bathed in the dark in this for three minutes, and then washed in a similar solution strongly diluted and dried at a moderate heat.—"Liesegang's Phot. Alm.," 1905, p. 59.

The Actien Gesellschaft für Anilin Fabrikation obtain cyanine dyestuffs for sensitising far into the red by oxidising methyl derivatives of quinoline alkyl haloids, the methyl group being in the pyridine nucleus (*e.g.*, quinaldine, lepidine); one only of these compounds may be used, or a mixture of one and a quinoline alkyl iodide. For example, 20 grammes of quinaldine iodomethylate are dissolved in 500 centimetres of water and oxidised with 25 grammes of potassium ferricyanide and 50 centimetres of concentrated caustic soda solution. The dye is extracted from the product by means of ether. Quinoline alkyl haloids alone give rise to no dyestuffs on oxidation.—Ger. Pat., No. 155,541; "B.J.," November 11, 1904, p. 963.

Chemistry of Cyanine.—Dr. Miethe and Herr Books discuss the chemical constitution of cyanine, advancing the view that it is not that usually supposed, the ground for this view being that ethyl red is not a periodide, but an addition product, as γ substituted chinoline gives no dye.—"Berichte," No. 8, 1904, p. 2008; "B.J.," February 24, p. 146.

This is shown to be erroneous, since α-γ-dimethylchinoline

on treatment with alkali gives fine blue cyanine dyes, which have a strong sensitising action.—Dr. S. Friedländer in "Berichte," 1904, p. 2821.

Panchromatic Plates.—For Hans Schmidt's method of using an acid cyanine, followed by alkaline erythrosine bath, see Section, "Colour Photography."

Kieser has examined a new series of dyes prepared by König by the action of halogen cyanogen on pyridine. Not one appears to be of any great value, and all are inferior to the isocyanines.

With all these dyes it is interesting to note that the maximum of sensitiveness is shifted from the place of maximum of absorption by no less than 1,000 Angström's units, whilst with the cyanines it is only 300, and with the eosines 400 units. All the dyes are light sensitive, and although no connection could be traced between the light sensitiveness and sensitising power, it is interesting to note that three out of the four dyes which do not sensitise are the least sensitive to light. So far plates bathed with the dyes have kept as well as eosine bathed plates.—"Zeit. für Wiss. Phot.," February, 1905, p. 6; "B.J.," March 10, 1905, p. 189.

Some New Sensitisers.—Valenta has continued his researches on the sensitising powers of various dyes.—"Phot. Korr.," August, 1905; "B.J.," August 18, 1905, p. 650.

Cyanine Sensitisers.—Dr. König, writing on the use of bathed or home sensitised plates, particularly with regard to pinachrome and orthocrome, first points out that bathed plates are more colour-sensitive than those coated with emulsion to which the dye has been added. Bathed plates are more stained on the surface of the film, but this cannot be the cause of the extra sensitiveness, for plates which have been bathed for so long that the film is stained right through evenly, still show increased colour-sensitiveness, and plates covered with a pinachrome emulsion and then bathed in pinachrome solution show the same sensitiveness as the undyed emulsion when bathed. Ammonia is frequently added to the dye bath, and with such dyes as wollschwarz or benzol-nitrobraun, this is absolutely essential in order to obtain any colour-sensitiveness at all. Basic dyes, such as the acridines, must be used without ammonia. Kieser has also proved that, with his new haloid-pyridine-cyanine dyes, ammonia is harmful. In the instructions for using orthochrome and pinachrome, it is stated that the ammonia may be omitted, and many plates, as is well known, cannot be sensitised with the isocyanines, because they fog sooner or later. This fog, Dr. König states, is caused by the use of ammoniacal sensitising baths, and if neutral baths are used the plates will keep for a month. The sensitiveness of the plates dyed in neutral orthochrome and pinachrome baths is, for practical work in the camera, equal for the green and four-fifths for the red, of those treated with ammonia. The actual sensitising bath recommended for the two dyes is :—

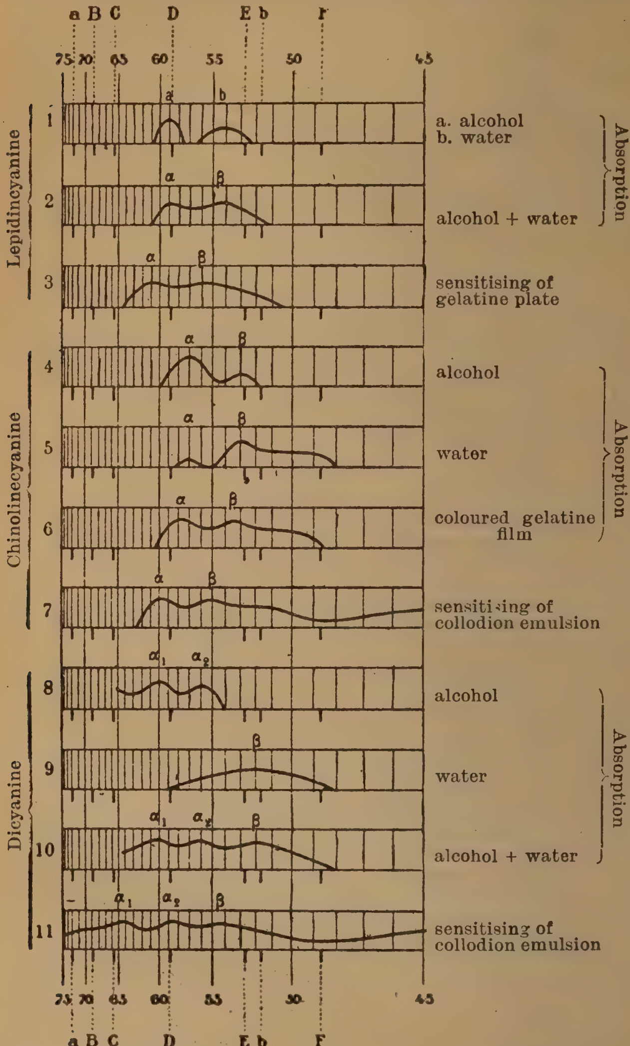
Dye solution 1 : 1000	3–4 c.c.s.
Water	200 ,,

the plates to be bathed therein for two or three minutes in the dark, and then washed for two minutes. Quick drying is not essential, and if allowed to dry spontaneously they work quite cleanly. Another advantage of the absence of ammonia is that ordinary tap water may be used to make the bath as a precipitate of lime is not to be feared. Dr. König states that the washing usually prescribed is not to remove excess of dye, and says that even the most soluble dyes cannot be washed out. The sole purpose is to remove the film of dye solution adherent to the front surface of the gelatine, which might otherwise cause streaks and marks. If a bath containing much alcohol is used the washing must be continued till the so-called greasy marks disappear. The author adds: "It is, perhaps, not generally known, that these greasy marks do not, or scarcely ever, appear, if instead of using ordinary ethyl alcohol to dissolve the dye, methyl alcohol be used. A pinachrome bath containing 1 per cent. of potassium carbonate, instead of ammonia, gives greater red sensitiveness than a mere aqueous solution. It is interesting to note that aqueous cyanine or isocyanine solutions are decolourised by neutral ammonium salts, such as the chloride or sulphate, and that the colour is restored by alkalies. Plates bathed with a pinachrome solution containing 1 per cent. of ammonium or sodium chloride show a greater sensitiveness than with a pure aqueous solution, but the sulphates do not act in the same way. In practice, however, it is advisable to use the plain bath.

Dr. König says that cyanine was discovered by Williams and more accurately studied by Dr. Hofmann, and it is the lepidine-chinoline-amyl-cyanine-iodide, which is insoluble in water, but soluble in alcohol, and rarely occurs in the pure state. The ethyl compound of above is more soluble in water, and is better for photographic purposes. Cyanine sensitised plates are in bad odour, the general sensitiveness is lowered to one-fifth or one-tenth, and spots and fog are very frequent. The latter are not due to the insoluble nature of the dye, because the nitrate and chloride, which are very soluble, also give rise to the same troubles. The lowering of the sensitiveness is due to the impurities in the cyanine, and Dr. König has proved that carefully purified amyl cyanine does not noticeably lower the general sensitiveness. Plates prepared with ethyl cyanine give greater red-sensitiveness than with amyl cyanine. Compared with pinachrome, the sensitiveness of the ethyl cyanine plates reaches in spectrographic tests further into the red, but the sensitiveness of the ethyl cyanine plates in the camera, behind the red filter, is rather less than pinachrome plates. "A spectrogram prepared with the help of a given dye does not give by itself any measure of the value of a dye for photographic practice.—"Phot. Korr.," September, 1905, p. 406.

The New Cyanines.—Von Hübl has examined the absorption and sensitising spectra of the old and new cyanines, and comes to the following conclusions:—1. Aqueous and alcoholic solutions of the cyanines contain the dyes in a different form. They can be distinguished by their colour, for the aqueous solutions are always

more reddish than the alcoholic, and, further, aqueous solutions



will run almost colourless through a filter. The different colour

of the solutions is not due to difference in dispersion of the solvent, for both solutions show the same absorption bands in exactly the same places, but their intensities are different. The difference is noticeable when the dyes are in solid media, and it is possible to distinguish whether they have been precipitated from aqueous or alcoholic solution. 2. The sensitising powers of the cyanines correspond to their absorption spectra in the solid state. As in gelatine plates, the β- band predominates: the minimum between this and the individual sensitiveness of the plate is smaller than with collodion. The displacement of the two bands by about 100 Angstrom's units can either be explained by screening action, or one must assume that the dye reacts chemically with the silver bromide, and that a coloured substance with another absorption spectrum is formed. 3. The disappearance or lag in sensitiveness corresponding to the α- band appears to be connected with the absorption spectrum of the dye adhering to the silver bromide. With reference to the "bands" mentioned above, it is as well to point out that Von Hübl finds that in aqueous solution the cyanines show absorption bands, the strongest of which lies about λ 560. This he calls the β- band, whilst in alcohol the strongest absorption lies nearer the red by a few wave lengths, and this he calls the α band.—"Eder's Jahrbuch," 1905, p. 183.

Dicyanine.—Von Hübl has examined a new dye, just prepared by Meister Lucius and Brüning, which presents some distinctly new features. It has hitherto always been assumed that chinoline was necessary to form cyanine, but this new dye possesses no chinoline ring, but two lepidine rings, and has been named as above by Dr. König on this account. In alcohol the dye gives a dirty-blue solution, in water a dirty-red solution. The absorption in alcohol shows two bands—A_1 maximum at λ 600, $A\frac{1}{2}$ maximum at λ 560 and in water one band with the maximum at λ 520. The sensitising of this dye extends from F right beyond α in the infra red of the spectrum. This is the most energetic red sensitiser yet known.—"Eder's Jahrbuch," 1905, p. 188.

Mixture of Dyes.—Miethe states that an addition of chinoline red to sensitisers of the cyanine class acts as a preventative of fog: the eosines may be used, but do not give such a closed spectrum. Five to six times the quantity of chinoline red should be used. The following formula is typical, and gives perfect freedom from fog and good general sensitiveness:—

Ethylcyanine nitrate (1 : 1000 alc. + water)	190 minims	20 c.c.s.
Chinoline red (1 : 1000 alc. + water)	2 ozs.	100 ,,
Water	20 ,,	1000 ,,
Ammonia	25 minims	3 ,,

—"Zeit. Wiss. Phot.," 1904, p. 272.

Tests of Ortho Plates.—Sir William Abney considers the rapidity and qualities of orthochromatic plates, and discusses the relative value of a candle light and the pentane standard lamp when making tests as compared with daylight. He assumes the action of the blue ray for a fixed time to daylight produces a photo-

graphic action of one, whilst that produced by the yellow is nothing. An orthochromatic plate may be taken in which the relative photographic actions of the two rays are equal. Suppose the action by the blue on the orthochromatic and the ordinary plate are the same; then the total action on it is represented by two, whilst on the ordinary plate it is only one. In this case the orthochromatic plate is twice as rapid to daylight as the ordinary plate. Using a pentane lamp as the source of light with which to give the exposures, the blue ray will have only one-tenth of the value that it has in daylight in such case. We may again call the value of the blue ray action on each unity. On the ordinary plate the action of the yellow ray is *nil* as before, but the action of the yellow ray on the orthochromatic plate will be ten times what it was before, so that its total sensitiveness becomes eleven. If, then, the effect on the ordinary plate is represented by unity, that on the ortho plate is represented by eleven, or the speed would be as eleven to one, whereas, with daylight, it is only two to one. Of course, this is only one example—perhaps an exaggerated example—of the relative action of two rays, but the same kind of argument applies to all. It is evident, then, that the speed of any ordinary plate, when compared with the ortho plate, suffers unjustly when such speed determination is arrived at from exposures made to the yellow light of a candle or other such artificial light. In this respect the speed of an ordinary plate—or, indeed, of any plate—varies according to the light in which it is to be employed, so that there is no exactitude in saying one plate is ten or any number of times greater than another, unless the kind of light with which the determination has been made is mentioned. In the crude example given above no doubt the correct figures are as two to one.

The interposition of a yellow screen is considered. In this case the blue rays would be extinguished and the yellow alone remain. The relative speeds of the two plates would then be one to infinity. If a third ray is introduced—say a green one—into the example, slightly modified results are obtained, and there would be some ratio representing the relative speeds with the yellow screen. The fairest way of indicating speeds is by a reference to daylight, and they will even be more nearly correct if the light used is that of the crater of the positive pole of the electric arc light—a light which most manufacturers can have at their command.—"Phot.," December 5, 1904, p. 12.

Testing Ortho Plates.—E. J. Wall, in a paper read before the London and Provincial Photographic Association, calls attention to the misleading results that may be obtained by relying solely on spectrograms and artificial light for testing colour sensitive plates, and quotes from various authors in support of his contention. The method he supports is that of Eder, who uses a solution of cupric sulphate, and one of potassium chromate in cells, determining the speed behind each. He also suggests using a red filter for determining the red speed, and for all tests, the acetylene standard light, recommended by Mees and Sheppard.—"B.J.," November 11, 1904, p. 926.

Practical Orthochromatic Photography, by T. Thorne Baker, is a small treatise on the subject which forms "P.M.," November, 1904, No. 67.

"Pract. Phot.," No. 22, May, 1905, consists entirely of articles and notes on orthochromatic photography.

LIGHT FILTERS.

Selective Filters.—The recording of only certain colours is pointed out as frequently of practical use, *e.g.*, when faint coloured typewriting has to be copied, or a copy made of a stained print so that the stains will not be so prominent in the copy. For recording blues, violets, and sometimes, in a lesser degree, the purples of the crimson group, an ordinary or wet plate is used. For greens, an ortho plate of the usual commercial kind is used behind a filter of ¼ per cent. solution of tartrazine, naphthol yellow or auramine, placed in a flat cell of about ¼ inch thickness. The yellows are recorded also. For recording reds, orange, yellows, and crimsons, a red-sensitive plate is used through a ¼ per cent. solution of Biebrich scarlet in ¼ inch cell. For recording a pure blue-green, a filter as follows is useful:—

$$\left.\begin{array}{l}\text{.1 solution of acid green}\\ \text{.1 ,, ,, tartrazine}\end{array}\right\}\text{equal parts.}$$

The spectral composition of colours is given as follows:—Reds often reflect light from the red end of the spectrum, but scarlet aniline dyes reflect also a little violet or ultra-violet. *Oranges* reflect all the red and yellow of the spectrum, and some green. *Brown* is simply dark orange *plus* black. Yellows reflect red, yellow, and green. Most yellow colours are as complex as this. There are some pure dull yellows such as mixtures of dyes such as Biebrich scarlet and naphthol green. Deep yellows do not contain all the green, and lemon yellows contain a little blue. *Green* may correspond to the whole or part of the green of the spectrum. Blue-green reflects a little blue, yellow-green the yellow, and perhaps a little red and pale green, a larger part of the spectrum including red and some blue. *Blue* is often very complex. Usually it reflects all the violet and blue, with proportions of red and violet. In application of the principle of selective filtration of the light in practical photography, for the copying of faint type-writing in violet ink on white paper, a yellow filter and green-sensitive plate will be needed. The dark violet ink reflects almost as much violet light as the white paper, but to distinguish between the two, the light which acts on the plate is cut out from the ink, which thus forms clear lines in the negative, while the white paper forms a dense ground.—"Pgm.," April, 1905, p. 105.

Correct Exposures when using Isochromatic Screens.—A. J. Anderson points out that the increase in exposure necessary with a particular screen varies in accordance with the nature of the emulsion of the plate employed, and instances the use of a nominally "ten-times" screen with five well-known makes of

isochromatic plates. The increased exposures varied from six times to twenty-five times. To test the correct exposure for a given plate with any screen (say, five times), he suggests cutting the plate or film lengthways into two sections, and place in lower position in two dark slides. The camera is focussed on a sheet of white blotting-paper in a good light. One piece is correctly exposed without the screen. The other piece is exposed with screen, but by drawing out slide it is exposed in three sections, one getting three times the correct exposure without screen, the next five times, and the third seven times. The two halves of the plate are developed together, and when fixed, washed, and dried, they are placed over some printed matter, film downwards, and the densities compared. The correct ratio of exposure can then be judged, and the right exposure for that screen and plate noted for use in the field.—" A.P.," March 28, 1905, p. 257.

Sir William Abney, speaking from results of a tour abroad, finds very little difference in landscape negatives taken on iso plates with and without a screen, save, that with decided haze in the distance the misty image with an unscreenedplate gave place to one fairly distinct where the screen was used, and the distant parts were more perfectly rendered. The mid-distance and foreground were rendered very nearly as well in the unscreened negative. For clouds and snow-scapes, the screen was found a decided advantage.

When changing orthochromatic plates on tour, the lamp is removed from the electric light fitting, and in its place is inserted a holder with some six yards of double strand wire attached. At the other end of the wire is a lampholder fixed on a three-inch flat wooden disc. The hotel lamp can thus be placed in any corner of the room, by the use of this attachment, and when shielded with a double cylinder of canary yellow and orange paper, is perfectly safe for ortho- and panchromatic plates.—" Phot.," November 19, 1904, p. 423.

Orange Filters for Panchromatic Plates.—Dr. Henger suggests that panchromatic plates may frequently be useful in ordinary work, such as landscape, etc. He suggests the use of the following filter:—

YELLOW SCREEN.

Gelatine solution	8 %	100 grammes
Tartrazine ,, ...	1 %	6 ,,

Allow 7 c. cs. to every 100 sq. cm. of glass.

RED SCREEN.

Gelatine solution	8 %	100 grammes
Echt-rot ,, ...	1 %	4 ,,

Allow 7 c. cs. to every 100 sq. cm. of glass.

When dry, one yellow and one red screen should be cemented film to film, and placed under a heavy weight in a warm room to dry, and then the edges bound. Such an orange filter will require an increase in exposure of eight times. With a lens

working at a large aperture, and in a good light, instantaneous exposures are possible.—"Atelier," June, 1905, p. 98.

Coloured Screens.—A. Callier has been photometrically examining the action of coloured screens, and points out that to diminish the action in any particular region of the spectrum, the logarithms of the illumination must be decreased by interposing a screen, the coefficient of extinction of which is log. i - log. i_1, in which i is the incident, and i' the transmitted light. Various density extinction curves are shown, and the conclusion come to is that an ideal screen is one which will render the spectrum according to the visual luminosity, and which reduces the curve on the plate from about λ 5000 to H. Unfortunately, the perfect screen requires such an increase of exposure that it becomes impracticable, and therefore a compromise is usual, and so-called "contrast" screens are made, which reduce more or less strongly the violets and blues. Various dyes were examined, and also commercial yellow glasses, these last proving to have too great an absorption in the blue-green, and also a marked absorption throughout the spectrum. Salts, such as bichromate and chromate of potash, were found to possess too great an absorption in the blue-green λ 5000. The following aniline dyes were also tested: Primuline yellow (Bayer) was useless, because it did not give clear solutions. Benzoflavine No. 2 (Oehler) was very insoluble in water, and rapidly faded; the same applies to acridine yellow T (Farbwerk Mühlheim). Auramine (Meister Lucius and Brüning) is not advisable as it is decomposed by ammonia. Picric acid is very suitable for screens, and it has a stronger absorption for violet than for blue; a greater strength than 1/1000 gm. per sq. centimetre is not possible, as it precipitates the gelatine. The dry picrates are preferable, and calcium picrate is the best. Martius yellow has a similar absorption to tartrazine, but is more insoluble. Naphthol yellow S is better than picric acid, but with 1/2000 gm. per sq. centimetre it crystallises out. Tartrazine (Meister Lucius and Brüning) is the best dye, but it passes the ultra-violet about λ 3625; it is therefore advisable to use a compound screen with aesculine Cyclamine gives a sharp absorption band about λ 5000, and is useful to correct over-sensitiveness at this region. A table of screens, and the necessary increase of exposures, is given, but this is for German commercial plates only. Aesculine in saturated solution plus 1/50000 gm. tartrazine per sq. centimetre with a yellow-green sensitive plate gives better results with an increase of exposure of 4½ times; with 1/35000 gm. tartrazine the increase in exposure is 6½ times. The best position of the screen is in contact with the plate. Good white glass of 1.5 to 2 mm. thickness should be chosen, and tested for parallelism by observing the reflection of an object from it when one surface is placed on a sheet of black velvet. Eight gms. of gelatine are soaked in water, and sufficient of the dye solution added, 3 c. cs. of glycerine, and sufficient water to make 100 c. cs. Seven c. cs. of this solution should be allowed for every 100 sq. cm. The coated glass should be placed on a levelled slab to set, then

dried, and either a cover glass cemented, or else the colouring matter divided between two glasses, and these cemented with Canada balsam dissolved in alcohol.—"Bull. Belge," April and May, 1905, pp. 123, 172.

Researches on Coloured Glasses. By A. Lecrenier.—"Chem. News," May 5, 1905, p. 207.

Making Light-filters.—M. F. Monpillard in preparing filters by solution of a given weight of dye in a given volume of gelatine solution, and using a definite volume of this latter for a certain area of plate, proceeds as follows:—

Taking first the case of a single dye, the coloured gelatine mixture is applied to two glasses, one placed horizontally and the other inclined so as to form an incline of 2 in 100. The volume of solution applied to the first glass having been determined with care, the weight, p, of colouring matter per unit surface is known. After drying, the gelatine film has a thickness, e.

The gelatine having been flowed over the inclined plate and dried, the latter is divided into two parts along its length, and to one of these strips a white glass is cemented with Canada balsam. A screen is thus obtained, constructed in the same way as the one required, but with the weights p_1, p_2, p_3 . . of dye per unit area varying in the same proportion as the thicknesses e_1, e_2, e_3. . . . of the gelatine film. This screen is then placed in an apparatus, by which the various parts can be gradually moved before the slit of the spectroscope. The latter is illuminated by a narrow beam of light, projected perpendicularly on to the screen by means of a cylindrical lens, which forms the image of a slit, the latter being brightly illuminated by the condenser of the projection lantern.

By means of the eyepiece of the spectroscope, the portion of the spectrum corresponding to that, for which the screen should show the maximum of absorption, is observed, and the screen is then slowly displaced until this result is obtained. The portion corresponding to the coloured region, which was illuminated at this moment, is then noted. On the other piece of glass, the thickness e_1 of the gelatine film is measured. The weights of dye being proportional to the thicknesses of the films, it is easy to calculate the weight per unit surface required for the depth of colour corresponding to that we require:—

$$\frac{e}{e_1} = \frac{p}{x} \qquad x = \frac{e_1 + p}{e}$$

When the colouration of the screen comes from two dyes, from each are prepared (as described above) a plain and a graduated screen. These latter are placed in juxtaposition by cementing the films with Canada balsam, so that the deepest part of the first comes next to the lightest part of the second. We thus obtain a screen in which the weights p_1, p_2, of each dye are inversely proportional. Passing this screen over the slit of the spectroscope, after we have located the region corresponding to the colour required, it is not difficult by measuring the thickness of the gelatine on each plate to find the ratio $\frac{p_1}{p_2}$.

By this method errors from differences in the absorptions of the dyes, according as the film is wet or dry, are avoided, and the thickness of the film at any point is ascertained from its position in the wedge-shaped coating of dyed gelatine.—"Compt. Rend.," July 3, 1905, p. 31; "B.J.," July 28, 1905, p. 587.

SAFE LIGHTS.

A blue-green safe light for collodion emulsion sensitised with ethyl violet. A. J. Newton and A. J. Bull point out that the spectrum of white light photographed on collodion emulsion sensitised with ethyl violet shows that the most insensitive region is not at the extreme red but between λ 5,000 and λ 4,600, where the colour is blue-green. Light of approximately this region is transmited when 4 milligrams per square cm. of brilliant acid green are employed in the filter of the dark room lamp. This gives a very comfortable light in which to work the emulsion, which is extensively used for making the blue printing negative in tri-colour work, and is much safer than any red light or yellow-green usually employed. In making this safe light it is convenient to coat (with gelatine) two glasses with half the proportion of dye in each, and when dry place face to face with *papier minerale* between.—"Phot. Journ.," January-February, 1905, p. 20.

ORTHOCHROMATIC WET COLLODION.

MM. Calmels and L. P. Clerc give the following formulæ in their "Les Procèdés au Collodion Humide":—

COLLODION.

Alcohol (pure 96 %)	100 c. cs
Cadmium bromide	20 grammes
50 % solution of eosine in alcohol (96 %)...	25 c. cs.
Alcohol (96 %)	300 c. cs
Ether (65°)	525 c. cs.
Nitrated cotton, H.T.	14 grammes
or	
Ether (65°)	175 c. cs.
20 % collodion	700 c. cs.

The plate is edged with rubber solution before the collodion is flowed on, with the object of preventing the lifting of the film in the considerably acid sensitising bath.

SENSITISING BATH.

Distilled water to make	1000 c. cs.
Silver nitrate	150 grammes
Alcohol	30 c. cs.
Acetic acid	A few drops

The plate is immersed until all greasy markings disappear. After exposure, and before development, it is placed for three minutes in the following bath:—

Distilled water, to make	1000 c. cs.
Silver nitrate	12 grammes
Nitric acid	A few drops

so that the plate may reach the developer containing nitric acid

in the pores of the collodion. In default of this, the image is grey and fogged. The other operations, fixing, intensification, etc., are done as usual.—"B.J.," January 13, 1905, p. 34.

Copying Coloured Originals by Wet Collodion.—Dr. C. Sturenburg employs a bromo-iodised collodion, and claims for this process the power to render various colours properly. *Collodions*: I. Absolute alcohol, 250 grammes; cadmium iodide, 1.87 gramme; ammonium iodide, 1.87 gramme; ammonium bromide, 3.75 grammes. II. Absolute alcohol, 250 grammes; cadmium iodide, 3 grammes; ammonium iodide, 3 grammes; ammonium bromide, 1.5 gramme. After solution of the salts, 20 grammes of pyroxyline, and 250 c. c. ether are added in each case. Both I. and II. keep well. The silver bath, suitable for either, is: Distilled water, 1200 c. c.; silver nitrate, 100 grammes; acetic acid, 10 c. c. The acid is high in order that the plate can be immersed for a long time, since the longer the bath acts the more bromide the film will contain, giving a plate more sensitive to dark colours and working more softly. Short immersion (= much iodide in the film) gives a plate yielding strong contrasts. Each collodion can thus give different effects, but I. is for soft negatives, when reproducing warm and dark colours. II. is for greater contrasts, and when copying less rich colours. Exposures must frequently be protracted—an hour or more—and then the plate is backed with wet blotting-paper. The developer is: Ferrous sulphate, 30 grammes, dissolved in 1000 c. c. water, to which are added 60 c. c. acetic acid, and 10 c. c. alcohol.

In using "ordinary" gelatino-bromide plates for copying coloured objects, stress is laid upon ample exposure, and upon reduction of the negative after fixing. The author prefers the pyro soda developer; A. Water, 500 c. c.; soda sulphite, 50 grammes; pyro, 7.5 grammes; sulphuric acid, 3 drops; potass bromide, 3 grammes. B. Water, 500 c. c.; soda carbonate, 100 grammes. Take A. and B., 1 part of each; water, 1 to 2 parts. —"Rev. Suisse," December, 1904, p. 521.

A Curious Orthochromatic Action.—M. Monpillard details his experiences when taking spectrograms on an antihalation plate, in which a coloured substratum was used. He found that although the emulsion was not orthochromatic, there was a fairly strong action near the D line. The dye used was found to belong to the Congo red family, and experiments with this by bathing showed similar colour-sensitiveness. M. Monpillard suggests that this orthrochromatic action was due to an absorption of a small quantity of the dye from the substratum by the fluid emulsion, and that Congo red and its allies might be useful in ortho work.—"Bull. Soc. Fr. Phot.," February 1, 1905, p. 88.

Developers and Development.

Solubility of Developers.—Charles Gravier has determined the

solubility of the principal developers in water and in solution of sodium sulphite, with the following results:—

Developing agent.	Solubility in 100 parts of water.		Solubility in 100 parts of 10 % solution of sodium sulphite at 15° C.
	15° C.	45° C.	
Adurol	100	more than 100	65
Amidol	30	33	28
Eikonogen	7.8	17	4
Glycine	0	0.2	Traces
Hydroquinone	6	14	4
Metol	5	9	2
Ortol	36	52	0.75
Paramidophenol hydrochloride	7.4	11	0.8
Pyrogallol	59	more than 100	59

—"Bull. Soc. Fr. Phot.," December 15, 1904, p. 579; "B.J.," February 3, 1905, p. 90.

DEVELOPERS.

Diamidophenol-Soda as a Developer.—Löbel, in "Rev. des S. Phot.," 1904, p. 214 et seq., recounted his experiments on the use of the phenolate of diamidophenol and diamidoresorcin as a developer, and gave the following formula:—

Water	1000 c. cs.
Anhydrous sodium sulphite	3 grammes
Amidol	5 ,,
Caustic soda 1% solution	30 c. cs.

Valenta points out that no less than 300 c. cs. of caustic soda would be required to form the phenolate, and experimenting on these lines, he comes to the conclusions:—(*a*) That an increase of the caustic soda increases within certain limits the rapidity of development; (*b*) the best effect is obtained when only enough soda is used to saturate the two HCl groups in the diamido phenol hydrochloride, so that the free base acts, and that even this developer can only be used once; (*c*) more soda so as to form the phenolate causes at once an intense blue colouration of the developer, and renders it useless. The following is therefore the amended formula:—

Water...	900 c. cs.
Sodium sulphite (cryst.)	10 grammes
Amidol	5 ,,
Caustic soda (1% solution)...	100 c. cs.

The diamidophenolate of soda is therefore useless.—"Phot. Korr.," January, 1905, p. 33.

Löbel points out that Valenta's conclusions are erroneous, and that there was a misprint in the original formula, and that it should have read:—

Water	1000 c. cs.
Anhydrous sodium sulphite	30 grammes
Amidol	5 ,,
1% soda lye	200 c. cs.

that with this increased quantity of sulphite the developer remains colourless, and that the relative rapidity of the developing is—

Acid solution	25
1 mol. NaHO	50
2 ,, ,, ,, ...	75
3 ,, ,, ,, ...	100

—"Phot. Korr.," April, 1905, p. 169.

Valenta retorts that whilst all journals are liable to typographical errors, it is curious that in a formula of only four lines two should appear, and that the formula should have gone the round of all the French and German papers without the author correcting the same. He also states that Löbel's new formula becomes deep blue, and gives much fog in 80 seconds, and that increase of the sulphite to 50, or even 100 gms., does not prevent this blue colouration, and therefore Valenta's formula can alone be used.—"Phot. Korr.," April, 1905, p. 171.

Hydrosulphites as Developers.—A. and L. Lumière and A. Seyewetz, who first discovered the developing action of hydrosulphites ("Bull. Soc. Fr. Phot.," 1887) now find that the pure anhydrous hydrosulphite of soda ($NaHSO_2$) is very different in its action from the impure product previously used by them. It is an energetic developer, giving a vigorous image, with, however, a good deal of fog. Bromide prevents this latter, and a good developer is:—

Sodium hydrosulphite	20 grammes
Potass bromide (10 % solution)	70 c. cs.
Sodium bisulphite (commercial solution)	100 ,,
Water	1000 ,,

Development is complete in about three minutes. Free acid, liberating hydrosulphurous acid, increases fog and lessens developing power. Also the strong smell of the solution prevents its use in practice. Unstable compounds of hydrosulphites, with organic bases such as diamidophenol, diamidoresorcin, etc., were less satisfactory as developers than sodium hydrosulphite.—"B.J.," December 23, 1904, p. 1086.

Hydrosulphites of Organic Bases. A. and L. Lumière.—"Bull. Fr. Chem. Soc.," January 5, 1905, p. 67.

Juglandin Developer.—Thomas Bolas suggests juglandin as a developing agent. Juglandin is a constituent of the thick green outer shell of the walnut, and in properties and composition has

somewhat close analogies with pyrogallol. These outer shells are shaved into thin slices, and just covered with water (½ lb. shells to 10 ozs. water), and the mixture is mashed for half an hour with the end of a wooden rolling-pin to force out the juice. The infusion is strained through calico, and is mixed at time of use with its own volume of a saturated solution of washing soda. This forms the developer, which is slow in action, but has no tendency towards fog or stain.—"A.P.," November 13, 1904, p. 393.

Metol-Hydroquinone Developer.—Hauff and Company give the following formula for this well-known combination:—

Hydroquinone	5 grammes
Metol	3 ,,
Water...	1000 c. cs.

When completely dissolved add—

Sodium sulphite	150 grammes
Potassium carbonate	40 ,,
,, bromide	1—3 ,,

For use, mix one part of above with one part of water. Development takes about four minutes. Temperature should not exceed 65 degrees F. For bromide paper the bromide should not exceed 5 grs. in 20 ozs. (= .5 gm. per 1000 c. cs.).—"Phot. Woch.," February 21, 1905, p. 74.

Paramidophenol and Formaldehyde.—It has been found that the condensation products of paramidophenol, or its sulphite compounds, obtained by the action of aldehydes of the aliphatic and aromatic series, are superior to paramidophenol. The products obtained with formaldehyde and acetaldehyde are particularly suitable. The production of these compounds may be illustrated by the following example:—144.5 gms. of paramidophenol hydrochloride and 120 gms. of potassium bisulphite are dissolved in 440 c. cs. of water, and, after cooling, 100 gms. of a 4 per cent. solution of formaldehyde are added. The sulphite combination of the product can be crystallised from this solution. As a developer, it is used in a dilution of 1 to 4 with a solution of 5 gms. of the sulphite combination, 25 gms. of potass carbonate, and 25 gms. of sulphite of soda in 100 gms. of water.—Eng. Pat., No. 23,729, 1904.

Buying Pyro.—It is not generally recognised that pyro bought by the pound comes out very considerably cheaper than when purchased by the ounce. The ounce cost is quite 30 per cent. above that per pound, *i.e.*, the money that will buy sixteen ounces in bulk will only buy twelve separate ounces in bottles, a loss of at least 2s. 6d. in the price of a dozen. This sum, and a further one of about 1s. 6d., is saved by purchasing pyro in the crystal form, which differs from the floculent only in taking a very little longer time to dissolve.—"B.J.," December 30, 1904, p. 1102.

Pyro-Glycin.—Ch. Martin recommends a two-dish method, employing four stock solutions. He first boils 1200 c. cs. distilled

water for 10 or 20 minutes to expel the air, and then dissolves 100 gms. anhydrous sodium sulphite in 800 c. cs. of it. After boiling for a further 10 minutes, boiled distilled water is added to make 1000 c. cs., which liquid is divided into one 500 c. cs. and two 250 c. cs. lots.

Solutions: A. (Pyro 2 per cent.) To 200 c. cs. of the cold sodium sulphite solution are added 5 gms. pyro, and the volume made up to 250 c. cs. with the sulphite solution. B. (Glycin 2 per cent.) To 250 c. cs. boiling sulphite solution, 5 gms. glycin are added, and the solution made up to 250 c. cs. with the boiling sulphite solution. C. (Potass or sodium carbonate) In 500 c. cs. of the hot sulphite solution, 38 gms. of sodium carbonate, or 50 gms. of potass carbonate, are dissolved, and a solution containing 8 per cent. sodium, or 10 per cent. potassium, carbonate is thus obtained. D. is 10 per cent. bromide of potassium.

Developer I.: A, 10 c. cs.; B, 10 c. cs.; C, 5 c. cs.; D, 6 to 8 drops.

Developer II.: A, 3 c. cs.; B, 3 c. cs.; C, 20 c. cs.; D, 4 drops.

The plate is placed in II. If the image appears rapidly (over-exposure), the development is concluded in I. If normally-exposed, only the high lights appear in I. The plate is then transferred to II., where the half-tones and shadows come up. If enough density is not obtained, the negative is placed back in I. for a few minutes.

If under-exposed, the image does not appear in I. It is then transferred to II., and left as long as may be necessary.—"Phot. Rev.," December 11, 1904, p. 186.

Soap in Pyro Developer.—Hofbauer suggests the addition of a small quantity of a 2 per cent. solution of soap to the pyro developer, the purpose of which is said to be the prevention of black spots in the film, which are caused by oxidised particles of pyro.—"Phot. Woch.," June 6, 1905, p. 223.

Acid Developers.—M. Maes recommends acidified pyro and other developers for slow development—thin, fine-grained, and fogless negatives. He claims suppression of halation and latitude in exposure as other advantages.

Formulæ. Pyro.

Sodium sulphite	40 grammes
Potass carbonate (dry)	8 ,,
Pyro	8 ,,
Potass bromide (10 % solution)	48 drops
Acetic acid (glacial)	48 ,,
Rain water (filtered)	1000 c. cs.

Amidol.

Sodium sulphite	40 grammes
Amidol	8 ,,
Potass bromide (10 % solution)	64 drops
Acetic acid (glacial)	64 ,,
Water...	1000 c. cs.

The author recognises that the pyro formula is not actually

acid, but contains sodium acetate. Addition of the latter, however, does not give the same results as that of acetic acid.—"B.J.," December 2, 1904, p. 1031.

The Keeping Properties of Amidol Stock Solutions.—MM. Lumière and Seyewetz have examined the cause of the deterioration of stock solutions of amidol (diamidophenol), using varying proportions of anhydrous sodium sulphite from .1 per cent. to 25 per cent., and they come to the following conclusions:—1. That the alteration of the amidol developer is not due to the oxidation of the sulphite, but to that of the amidol, and that the sulphite oxidises less rapidly in the presence of amidol than in a mere aqueous solution. 2. That excess of sulphite over the normal quantity used in the developer actually hastens the oxidation of the amidol. 3. Concentrated solutions of sulphite and amidol keep worse than a normal solution, in consequence of the precipitation of the base of the amidol. 4. The normal solution, of which the following may be taken as the type, is:—

Water	1000 c. cs.
Amidol	5 grammes
Sodium sulphite anhydrous	30 ,,

Will keep without appreciable alteration for some time in full and well-corked bottles.—"Bull. Soc. Fr.," March 1, 1905, p. 126.

Bernard C. Roloff suggests the following formula for obtaining brilliant negatives:—

Sodium sulphite (anhydrous)	150 grs
Amidol	15 ,,
Edinol	15 ,,
Water	3½ ozs.

—"Cam. Craft," August, p. 360.

Practical Methods of Development is the subject of "PM.," No. 66.

TIME DEVELOPMENT.

Development Factor and Temperature.—W. J. Fergusson and B. F. Howard record the results of experiments made to determine the variation of the Hurter and Driffield development factor with the temperature of the developer, and show how to construct a chart by which the photographer can adjust the time of the development to the temperature of the developer so as to obtain an equal development factor at different temperatures. When obtaining the development factor from photometric measurements of densities (tangent of the angle between the line of correct exposure and the base line representing the inertia of the plate), they find it useful to confirm the accuracy of the measurement by multiplying the mean regular highest difference of the successive densities measured in the photometer by the figure 3.33.—"Phot. Journ.," March, 1905, p. 118; "B.J.," March 31, 1905, p. 249.

Time Development.—R. Child Bayley reviews the introduction of development by time, and advances the following reasons for its adoption:—

"1. It gives us perfectly uniform negatives when exposure has been correct, whether we develop daily, or only have a few to deal with every now and again.

"2. It brings everything out that can be got out of an under-exposed plate, and removes the temptation to over-develop in the hope that more details may be obtained.

"3. It gives us as good a result as can be got with over-exposed plates, and prevents any risk of insufficient development which may be caused by the difficulty of judging how far development has gone when the plate is very opaque.

"4. It reduces light fog to a minimum, and in the case of roll films does away with it entirely.

"5. It overcomes entirely the difficulty of determining when development is complete.

"6. It can accommodate itself to the nature of the subject or to the printing process to be used, or may be settled once for all to give a good 'all-round' negative."

The paper gives a full description of the "Tyma" and "Kodak" developing machines.—"Journ. Soc. Arts," February 10, 1905, p. 306; "B.J.," February 24 and March 3, 1905, pp. 149 and 170.

STAND DEVELOPMENT.

Pyrocatechine.—Dr. Linden recommends the following formula:—

A.	Procatechine	20 grammes
	Acetone sulphite	14 ,,
	(Or sodium sulphite	100 ,,)
	Boiled water...	1000 c. cs.
B.	Sodium tribasic phosphate	200 grammes
	Boiled water..	1000 c. cs.

For use the above are mixed in equal parts, and the mixture diluted with thirty times its volume of water. Duration of development, about an hour.—"Phot. Mitt.," II., April, 1905, p. 113.

Edinol.—The late Dr. Englisch suggests the following formula for stand development:—

Edinol	1 gramme
Sodium sulphite	1 ,,
Water...	1000 c. cs.

and add

For under-exposure—

Potassium or sodium carbonate	5 grammes

For over-exposure—

Potassium or sodium carbonate	2 grammes

—"D. Phot. Kal.," 1905.

DEVELOPMENT MISCELLANEA.

Mountainous Scenery.—Wipplinger strongly recommends, from considerable practical experience, the following acetone developer as the most suitable for obtaining perfect gradation of snowy mountain scenery. A stock solution is first made:—

Water	1000 c. cs.
Sodium sulphite	400 grammes

When dissolved, filter and add—

Sulphuric acid, pure	16 drops
Pyro	28 grammes

For use 25 c. cs. is mixed with 75 c. cs. of water and to this—

Acetone (white)	3 c. cs.

is added, well stirred, and applied to the plate. After about a minute and a half 7 c. cs. of acetone are added by degrees. The total time of development is eight or ten minutes.—"Der Am. Phot.," January, 1905, p. 7.

Potassium Persulphate in Development.—C. Winthrope Somerville suggests potassium persulphate as a substitute for potassium bromide in the developer. With excessive over-exposure development is retarded to less extent than with bromide, but the tones in the gradation scale are perceptibly maintained in deepest shadows, while the lighter tones are inappreciably affected. A general softening effect over the whole scale of gradation is observed, and with under-exposure or subjects with harsh contrasts it is useful.

A 10 per cent. solution should be employed, and it is of great use in transparency work.

When incorporating it with bromide, the proportion should be about one and a half times greater, *i.e.*, to every 10 minims of bromide add 15 of persulphate. If used alone, double the proportion of bromide generally employed.—"A.P.," January 3, 1905, p. 13.

Development of a Fine-Grained Image.—Lumière and Seyewetz find that slow development in a solution which contains a solvent of silver bromide favours the finest grain. The best developer is:—Paraphenylene diamine (slight solvent of silver bromide), 10 gms.; anhydrous soda sulphite, 60 gms.; water, 1000 c. cs. Or 5 to 30 gms. of ammonium chloride is added to 100 c. cs. normal hydroquinone developer.—"Phot. Korr.," November, 1904.

A Portable Developer.—Developing while away from home is the subject of an article by Capt. W. Osbaldeston, who recommends carrying the following developer in dry form. The chemicals necessary are half a pound of sodium carbonate ("dry B.P."), half a pound of sodium sulphite (anhydrous), and an ounce of pyrogallic acid. Thin waxed paper is cut into pieces about 5 by 4, and in each of these are weighed out 6 grains of pyro and 6 grains of sulphite. They are then made into small packets, tied up with cotton, and dipped into melted wax. An equal

number of packets are made up, each containing 30 grains of sodium carbonate. Hypo is put up in 2 oz. packets in the same way, but need not be waxed. The developer is mixed in an 8 oz. wide-mouthed bottle with a good cork. On the side a 3 oz. mark is scratched. The contents of a packet of pyro, sulphite and of soda carbonate are shaken up in 3 ozs. of water in the bottle, and the developer is ready for use. The little waxed packets of chemicals will last indefinitely, and can be easily carried.—"Phot.," July 25, 1905, p. 66.

Rapid Plates.—T. Thorne Baker, in a paper before the Photographic Convention, treats of the differences between slow and fast plates :—

Slow Plate : Fine grain (giving density in a short time), steep gradation curve (*i.e.*, giving contrasts readily), and little liability to reversal with over-exposure.

Fast Plate : The reverse of these conditions, comparatively coarse grain (giving density only on prolonging development), long scale of gradation tending to soft results, and occurrence of reversal soon after the normal correct exposure has been received.

The faster the plate, the more readily is bromide absorbed by the gelatine. This may be taken as a general axiom. And until some fresh methods of manufacture are devised the rapid plate will always have greater tendencies than the slow plate to (i.) large grain, (ii.) fogging of the gelatine surrounding the granules, (iii.) steady gradation, and (iv.) lack of density in the deep shadows.

In reference to the red-sensitiveness possessed to a certain extent by ordinary extra-rapid plates a safe-light for the dark room should be used with care almost equal to that for iso plates. A suitable dye-solution for a tank filter for the dark-room lamp consists of tartrazine, 3 parts; Titan scarlet, 2 parts. This is dissolved in water in quantity varying according to the thickness of the cell. The colour should be such that a little pure yellow and orange passes through the solution, but the maximum luminosity is in the pure red beyond C. A fairly strong solution of Mandarin orange is also suitable for tank lamps.

A deep red or black backing should be used for extremely rapid plates. As regards speed numbers, it is recommended that H. and D. numbers with metol-hydroquinone and similar developers should be given, this speed being approximately 1-4/5ths that obtained with ferrous oxalate as developer. Also in giving such "practical" speed numbers, bromide, almost invariably used, should be a constituent of the test developer. Pyro is given as the best developer for rapid plates, and the following formulæ specially recommended :—

A,	Pyro	130 grains	30 grammes
	Citric acid	110 ,,	25 ,,
	Sodium sulphite ...	$1\frac{1}{2}$ ounces	150 ,,
	Water	10 ,,	1000 c. cs.
B.	Sodium carbonate ...	$2\frac{1}{2}$,,	250 grammes
	Water	10 ,,	1000 c. cs.

The great charm about this developer is the evenness of gradation which it gives, and negatives with a very wide range of tone are readily obtainable with it, in which the deepest shadows can be printed through.—"B.J.," July 21, 1905, p. 571.

Boric Acid as a Restrainer.—Namais strongly recommends the use of boric acid as a restrainer for over-exposure. He uses a saturated solution of the acid in a 10 per cent. solution of potassium bromide, and the following developer:—

Sodium sulphite	50 gms.
Hydroquinone	7 ,,
Metol	1 ,,
Sodium carbonate, anhydrous	30 ,,
Water	1000 c.c.s.

To every 100 parts of this developer, 10 parts of the boric-bromide solution should be added. Over-exposures of 40 and 100 times can thus be saved.—"Il. Prog. Foto.," May, 1905, p. 81.

Developers for Reproduction.—Sturenberg recommends the following developers as specially suitable for all classes of reproduction work:—

GLYCIN DEVELOPER.

Sodium sulphite	100 gms.
Sodium carbonate	60 ,,
Glycin	20 ,,
Potassium bromide	4 ,,
Water	1000 c.c.s.

HYDROQUINONE-EDINOL DEVELOPER.

Sodium sulphite	120 gms.
Sodium carbonate	60 ,,
Potassium bromide	8 ,,
Hydroquinone	10 ,,
Edinol	4 ,,
Water	1000 c.c.s.

PYRO DEVELOPER.

1.	Sodium sulphite	100 gms.
	Pyro	15 ,,
	Sulphuric acid	6 drops
	Potassium bromide	6 gms.
	Water	1000 c.c.s.
2.	Sodium carbonate	200 gms.
	Water	1000 c.c.s.

For use, mix equal parts of 1 and 2, and add 1 or 2 parts of water.—"Apollo," June 8, 1905, p. 124.

Chemical Luminescence.—Trantz and Schorigin have been examining this phenomenon, which has been called phosphorescence, and is sometimes seen in the development of dry plates. They find that it has nothing to do with the gelatine or silver salts, as

filter paper or certain solutions will show it, and that it is dependent on oxidation; they also suggest that probably all organic substances which oxidise under about 400 degrees are capable of showing this phenomenon.—"Zeit. für Wiss. Phot.," April, 1905, p. 121.

Dichroic Fog and Developers.—Dr. Lüppo-Cramer recalls his observation ("Phot. Korr., 1904, p. 167), that at certain dilutions of the developer the sulphite may dissolve silver bromide, and thus give rise to dichroic fog. As to the influence of bromide, he confirms the statement of Lumière and Seyewetz "Zeit. für Wiss. Phot.," Vol. I., p. 196), that moderate addition of bromide is powerless to prevent yellow fog, when purposely caused (as in Cramer's experiments) by additions of sulphocyanides, etc., to the developer. Twenty minutes' development in a hydroquinone-soda carbonate developer (Cramer's standard formula), *plus* (*a*) 5 c. cs., and (*b*) 20 c. cs. 10 per cent. potass bromide solution per 200 c. cs. of developer gave with (*a*) both chemical and dichroic fog, with (*b*) dichroic fog only. Pyro and adurol, used in same formula and with the dose (*b*) of bromide, gave appreciably more fog; edinol and glycin, less; pyrocatechin, none; metol, a trace. For an equal amount of development, pyrocatechin and hydroquinone gave the one a pale yellow fog, the other a deep red, and the general conclusion is that developers differ in giving colour fog much as they do in producing chemical fog; that is, according to Andresen ("Phot. Korr.," 1899, p. 212), developers which bring up the image slowly afterwards fog strongly.—"Phot. Korr.," December, 1904, p. 554.

Dr. A. Traube confirms these results of Cramer's, and states that emulsions with chemical fog need not be developed so long as others to show colour fog. The worst case of colour fog was that of a fresh iso plate, developed for two minutes, and put aside for ten minutes, when it was seen to be violet by transmitted light, and to consist of a green fog. Traube finds ordinary plates almost exempt from colour fog.—"Phot. Chron.," No. 63, 1904.

Physical Development and Dichroic Fog. Lüppo-Cramer, 1905. —"Phot. Korr.," April, 1905, p. 159.

FIXING AND HYPO-ELIMINATORS.

A Cold Fixing Bath will Cause Stain.—In attempting to locate the cause of deep yellow stain which occurred with fresh developer and clean fixing bath, the trouble was at last traced to the fixing bath. It was noted that the temperature of the latter was extremely low, and when tested proved to be only 40 degrees F. A portion of this bath was then heated to 65 degrees F., and a plate exposed and fixed in this, with the result of total disappearance of the stain. We tried this by exposing two quarter-plates in a stereoscopic camera, developing together, and fixing one in a hypo solution cooled to 38 degrees F., and the other in a bath at 60 degrees F., with precisely similar results. The cold fixing bath gave a deep yellow stain,

and the warm one perfect freedom from the same.—"B.J.," December 9, 1904, p. 1042.

Hypo-Eliminators.—A. G. Woodman reviews various suggested agents:—

(1.) Dilute iodine solution. This instantaneously changes the hyposulphite into a quite innocuous compound, but it also has a tendency to form iodide of silver, *i.e.*, bleach the negative.

(2) Dilute bromide solution. This also rapidly oxidises the hyposulphite, but likewise acts upon the silver image.

(3.) Hypochlorites. The alkaline hypochlorites act readily on sodium hyposulphite, but if used at all concentrated they also act on the silver image.

(4.) Sodium peroxide. This oxidises the hypo only slowly if diluted, and if concentrated attacks the gelatine sufficiently to disintegrate the image.

(5.) Hydrogen peroxide. This is an excellent hypo-eliminator, and has no bad action on either the image or the gelatine.

(6.) Chromic acid and potassium bichromate. These, with the addition of sulphuric acid, oxidise hypo very readily, but also attack the silver image. Without the acid they are of no practical value, as the action is very slow.

(7.) Potassium permanganate. This oxidises and destroys hypo instantaneously, but exercises a very manifest action on the silver image.

(8.) Potassium percarbonate. This acts energetically on hypo, but its action only takes place during the solution of the solid percarbonate in water.

(9.) Ammonium persulphate. This, mixed with an alkali, is an excellent eliminator of hypo, and is regarded as the best of those considered.—"Cam. and Dk. Rm.," April 1905, pp. 107-8-9-10.

Fixing Baths Acidified with Boric Acid.—R. Namias states that if boric acid is added to a fixing bath till saturated, any possible troubles due to the introduction of small traces of developer are avoided; it is also much more effective than sulphite. A 30 per cent. solution of hypo saturated with boric acid shows no decomposition, even after some weeks. [With regard to the action of boric acid on hypo, Valenta has proved ("Behandlung der Emulsions Papiere," 1896, p. 120) that the hypo *is* decomposed, but much more slowly than with a stronger acid.—Ed., "B.J.A."]—Atelier," July, 1905, p. 104.

Fixing in Daylight.—Lüppo-Cramer states that plates may be fixed in not too bright daylight without any harm, but that in strong daylight or sunlight reduction of the silver takes place. He ascribes this to a sensitising action of the hypo. The slower the plate fixes, the more the fog.—"Eder's Jahrbuch," 1905, p. 417.

Destruction of Plates by Microbes.—Reiss and Galli-Valerio have found that when washing plates and papers in certain river waters numerous spots are caused, and these were traced to colonies of actinomyces chromogenes.—"Phot. Chron.," 1905, p. 139.

After Treatment of Negatives.

INTENSIFICATION.

Intensification Unlimited.—M. Popowitsky, before the Russian Photographic Society, suggests the following for very thin negatives. On the negative is fastened at one corner a little right angle of cardboard, so as to ensure the accurate register of the glass that is used to obtain the print. M. Popowitsky used a collodio-chloride emulsion made according to the formula of Kleffel, thus:—

1.	Water	6 c. cs.
	Silver nitrate	5 gms.
	Alcohol 90 deg.	100 ccs.
2.	Calcium chloride	2 gms.
	Alcohol 90 deg.	100 ccs.
3.	Citric acid	2 gms.
	Alcohol 90 deg.	100 ccs.

No. 1 is added in small quantities and with constant shaking to 240 c. cs. of a $1\frac{1}{2}$ per cent. collodion, and then Nos. 2 and 3 are added drop by drop with constant shaking, and the emulsion allowed to stand for an hour or two to ripen. A sheet of glass is coated with this emulsion, and when dry is placed in contact with the negative, and a faint image printed out and developed to full intensity with—

Gallic acid	5 gms.
Lead acetate	3 gms.
Acetic acid	7 gms.
Water	1500 c. cs.

The print is then fixed, washed, and dried, and coated with—

Rubber solution	3 parts.
Toluol	7 parts.

The rubber solution should be of 5 per cent. strength in benzole. When this is dry, another collodion coating is given, and again it is printed out and again developed, fixed, and dried, and these operations repeated till an image of sufficient intensity is obtained, from which a duplicate negative can be made.—"B.J.," December 16, 1904, p. 1062, from "Bulletin of Italian P. S."

Silver Bleaching Agents used in Intensification, Reduction, and Toning.—C. Winthrope Somerville treats exhaustively of the rehalogenised silver image, and gives the salient features of a number of bleaching agents available for the purpose of intensification, reduction, and toning. These reagents convert the metallic silver forming the image into the bromide, iodide, chloride, and ferrocyanide salts of that metal, and these are either developed for the purpose of intensification or converted into the sulphide salt by the application of a suitable reagent for toning. In the redevelopment process the lightest tones develop up first, the lower ones following considerably later;

hence, if the image at any point between initial and complete development be subjected to hypo, the halogen salt left in the film is dissolved, with the result that the lightest tones have gained in density while the lowest are incompletely reduced. thus producing a levelling of the gradation scale for both ends. The following formulæ are given:—

1.	Potassium ferricyanide	2 grs.
	Potassium bromide	3 grs.
	Water	1 oz.

This solution can be made stronger if necessary, and keeps indefinitely if kept in the dark.

Washing for 15 minutes is all that is required after any of the processes, except after reduction in hypo. Redevelopment may be effected with practically any developer, but it is decidedly preferable to use one of the non-staining variety, such as metol-hydroquinone.

Toning is carried out by applying a solution of sulphuretted hydrogen, not stronger than 1 per cent. of the sulphide salt.

2.	Potassium bichromate	15 grs.
	Hydrochloric acid	10 minims
	Water	1 oz.

This solution may be used for bleaching over and over again. After-treatment, same as for No. 1.

3.	Copper sulphate	10 grs.
	Potassium bromide	17 grs.
	Water	1 oz.

The plate or print is soaked in water until the film is soft, then immersed in this solution until completely bleached. It is then washed for a few minutes, and placed in a 5 per cent. solution of nitric acid for two minutes, again washed and exposed to daylight if for intensification. If toning is intended, the bleaching must be carried out in gaslight.

4.	Copper sulphate	10 grs.
	Potassium or sodium chloride	20 grs.
	Water	1 oz.

After bleaching, a 4 per cent. solution of hydrochloric acid is applied to free the film of any cuprous chloride formed, otherwise the after-manipulation is similar to that of the cupric bromide process.

5. When the image is bleached with cupric iodide, it cannot afterwards be re-developed.

6.	Potassium or sodium chloride ...	10 grs.
	Potassium ferricyanide	5 grs.
	Hydrochloric acid	5 minims
	Water	1 oz.

Little or no intensification occurs without exposure to light previous to redevelopment. Sulphiding the bleached image gives a fine cold sepia tone.

7.	Potassium iodide	5 grs.
	Potassium ferricyanide	5 grs.
	Saturated solution of oxalic acid ...	50 minims
	Water	1 oz.

Bleaching is slow with this formula, which is not recommended for intensification, as the image is only partially developable after protracted exposure to light. Sulphiding gives a good sepia tone.

8.	Potassium ferricyanide	10 grs.
	Ammonia .880	5 minims
	Water	1 oz.

Developable only to a certain degree, but fine sepia tones are obtained when sulphided.

9.	Potassium bichromate	10 grs.
	Potassium bromide	10 grs.
	Hydrochloric acid	5 minims
	Water	1 oz.

The hydrochloric acid may be increased if greater rapidity is required. The stain after bleaching is removed, with a 5 per cent. solution of potassium metabisulphite. Otherwise same in action as No. 2.—"P.N.," December 9, 16, 23, 1904.

C. Winthrope Somerville gives his method of oxidising the latent image before development for the purpose of preventing the accumulation of excessive and undue density in the highest lights of a negative and shadows of a positive. He immerses the plate for half a minute before development in:—

Copper sulphate	1 gr.
Potassium persulphate	2 grs.
Nitric acid	5 minims
Water	4 ozs.

He gives a gradated scale showing different comparative densities obtained with varying exposures and different developers.—"A.P.," August 8, 1905, p. 109-110.

Intensification with Chromium.—C. Wellborne Piper and D. J. Carnegie find that considerable intensification can be obtained with potassium bichromate solution followed by re-development. The plate is bleached in the A., B., or C. solution given below, according to the degree of intensification required. B. gives results almost exactly equal to those obtained with mercury and ferrous oxalate. The effect of A. compares with that of mercury and ammonia; that of C. with mercury and sodium sulphite.

	A.	B.	C.
Potassium bichromate... ...	5	10	10 grains
Hydrochloric acid (sp. gr. 1.160)	1	5	20 minims
Water to...	1	1	1 ounce

Solution A should be made with distilled water.

The more acid the bleaching solution, the weaker the intensification, and to obtain the strongest effect it is necessary to reduce the relative quantity of acid, and to dilute the solution. Adherence to exact formulæ is necessary for constant results. As soon as the plate is completely bleached, *i.e.*, as soon as the last tinge of greyness has disappeared from the front (a change which is easily observable as the plate lies in a porcelain dish), the plate is removed. After washing out the bichromate stain in water—time, 10 to 30 minutes—the image is re-developed in :—

Amidol	5 grains
Sodium sulphite, 10 % solution...	1 ounce

In place of the rather lengthy washing necessary after the bichromate, the plate can be rinsed once or twice for an instant only with a 2 per cent. solution of meta-bisulphite. The solution must not be stronger, nor used for a longer time, or there will be great loss of density. With solution B., and amidol as the re-developer, the process of intensification can be performed repeatedly. Two successive operations give the intensification usually obtained with mercury and ammonium sulphide. Sodium bichromate is not found to be so suitable as the potassium salt.

Water is the safest eliminator of the yellow stain, but, if used as described, no risk is run with meta-bisulphite, which is the best chemical destroyer of the bichromate, and does its work in about two minutes.

Amidol is preferred as a developer because it is powerful and rapid in its action, and is only faintly alkaline. Any strongly alkaline developer, if applied several times, produces frilling sooner or later, but if a reagent other than amidol is to be used, glycine, without bromide, and with sodium instead of potassium carbonate, should be chosen. Either of these two gives full density in less than five minutes, whereas, hydroquinone requires ten to fifteen minutes.

The B. solution should be used for repeated intensification. The results appear to be perfectly permanent, and the process is always easy, effective, and safe, and can be used for black tone lantern slides, the tone of which it preserves.

In dealing at length with the theory of the process, the authors prove that the intensified image contains chromium, probably in the form of Cr_3O_4. The actual bleaching agent is very probably $KClCrO_3$ (potassium chloro-chromate), which, acting on the silver image, produces a photo-chloride of silver.—"A.P.," June 6, 13, and 20, 1905, pp. 453, 473, and 505.

Intensification with Iodine.—C. Welborne Piper and D. J. Carnegie have worked out the following process, and recommend it for perfectly permanent results. The intensification is about as great as that with mercury and sodium sulphite. The plate is bleached in :—

Iodine	7½ grains
Potassium iodide	15 ,,
Water to	2 ounces

The two solids are weighed out, mixed in the dry state, and

wetted with water, when the iodine straightway dissolves, and the solution is then diluted to 2 ozs. When completely bleached, which is the case in a few seconds, with a fresh solution, the plate is treated in a hydroquinone developer and left until all iodine stain is gone. When this is the case it is lifted out of the developer, four inches of magnesium ribbon burnt on each side of it, an inch or two away, and the plate then put back in the developer to blacken. About ten minutes is usually necessary, and then the plate is washed a half an hour. The hydroquinone developer should be made up with caustic soda, not carbonate, the following "Imperial" formula having proved satisfactory :—

No. 1.	Hydroquinone	150 grains
	Potassium metabisulphite	10 ,,
	Potassium bromide	50 ,,
	Water to	20 ounces
No. 2.	Sodium sulphite	2 ounces
	Caustic soda	100 grains
	Water to	20 ounces

For use take equal parts of Nos. 1 and 2.

In discussing the theory of this process, the authors cite experiments to prove that the increase in density is solely due to enlargement of the granules of the image, by the addition of iodine. —"A.P.," June 27, 1905, p. 517.

REDUCTION.

Persulphate Effect with Farmer's Reducer.—John Bartlett, before the Photographic Society in Philadelphia, describes a method of using the ferricyanide-hypo reducer to obtain the softening and harmonising action of persulphate :—

The method is to reduce immediately after fixing, when possible, making the film acid with acetic or citric acid and then to place merely in a 5 per cent. solution of ferricyanide of potassium— lifting the plate after a few minutes' action to note the progress, for the action must not be allowed to continue too long or the shadows will pay for it.

When it is necessary to reduce a plate which has been thoroughly washed from hypo, the plan is first of all to soak the film in a bath of weak acid, say a 10 per cent. solution, for 5 or 10 minutes, and then transfer to a bath of hypo for another 5 or 10 minutes, and finally subject it to the action of the ordinary Farmer's solution, that is, one constituted with twice or three times the amount of hypo over the ferricyanide solution and made acid by addition of acetic or citric acid sufficient to redden litmus paper.

Intense plates may thus be reduced as effectually as with persulphate and with less trouble or manipulation.—"Journ. Phil. Phot. Soc.," May-June, 1905, p. 22; "B.J.," August 11, 1905, p. 625.

Cobaltamine Reducer.—Harry E. Smith finds the cobalt ammonium nitrite, known as Erdman's salt, to act as a convenient reducing agent in acid solution. Four grains, or .25 gms., are

dissolved in 50 c. cs. of water, and an equal bulk of 15 per cent. sulphuric acid added. The salt should be dissolved by the aid of heat, and the acid added after cooling. If necessary the salt can be kept in solution (in the dark) and mixed in equal proportions with the acid at the time of use. After reduction the negative or print is placed in 10 per cent. ammonia solution for three minutes (to counteract a tendency to brownish colour), and finally washed for ten or fifteen minutes. The reducer acts selectively on the denser parts of the negative in preference to half-tone and lighter detail. It thus serves for treating hard negatives. The reducer is slow in its action, and there is little fear of the process going too far after the plate is removed. A number of other complex nitrites of cobalt can be used, or made up in solution with a cobalt salt, potassium nitrite, dilute sulphuric acid, and salts of ammonium, etc.; but the action of these mixtures is not usually as good as that of the pure compound.—"Phot. Journ.," May, 1905, p. 185, "B.J.," May 26, p. 401, June 2, 1905, p. 437. The reducer is patented (Harry E. Smith. Eng. Pat. No. 6,276, 1905; "B.J.," June 16, 1905, p. 473.)

S. E. Sheppard, examining the Erdman's salt-reducer, finds that the action is slow, and varies for different plates. On measuring the density before and after reduction of a series of graded scales exposed in the sensitometer, it was found that very slight reduction took place during the first 30 minutes; during a further 45 minutes more rapid reduction took place, the selective action being marked in the lower tones. This result was with a slow plate. With a rapid one, on the contrary, the reduction was found to increase slightly with the density. It appears necessary to keep the reducer moving, otherwise mottling occurs.—"Phot. Journ.," July, 1905, p. 267.

STRIPPING NEGATIVES.

Professor Namias says that the usual method of stripping gelatine films from glass is first to harden them with formaline and then immerse in hydrofluoric acid, and that this does not prevent an extension of the film; further, the hydrofluoric acid is dangerous in use. His method is more economical, and is based on the coagulating effect of basic chrome alum, which he first discovered in 1902; this is made by adding ammonia to a boiling 20 per cent. solution of ordinary chrome alum, till a permanent green precipitate is formed; the solution should then be filtered. The negative must be first soaked in water till soft, then immersed in the chrome alum for half an hour. Namias lays great stress on the soaking of the plate, stating that otherwise only the surface is coagulated, and that this is the case with all hardening agents. Lumière and Seyewetz's statement that all chromium salts in a basic state harden gelatine may be correct, but chrome alum is the best; basic chloride, acetate and tartrate of chromium were tried, but they all lost their hardening effect when the film was immersed in an acid.

Hydrofluoric acids may be re-placed with entire success by the

use of 5 per cent. solution of fluorides of sodium or potassium, and 1 to 2 per cent. of sulphuric or hydrochloric acid.

Namias recalls Spielberg's method of forming basic chrome alum by adding metallic zinc to the chrome alum solution. On allowing it to stand for several days, the free acid is neutralised and any sulphate of zinc formed is harmless. Professor Colombo, an Italian amateur, has privately communicated to Namias the following method of stripping a film. The plate should be laid, without any preliminary alum bath, in a cold saturated solution of carbonate of soda for ten minutes, then dried and again immersed in the soda solution, and it will then readily strip.—" Atelier," February, 1905, p. 27.

RETOUCHING NEGATIVES.

How to Retain the Likeness.—Arthur Whiting advocates the following method in place of the common practice of working cleanly across the negative from corner to corner :—

The better method of procedure is to work *successively* from high lights through the half-tones to the shadows, as follows, viz. :—First look to the highest lights on the face. If these contain blemishes which, however, will not show on the print, or, in other words, which will not print through, it is better to leave them alone; for whilst working upon them may make the negative look more finished it will make the subject in the print less so. If the negative is somewhat hard, or strongly lighted, it is more than possible that none of the highest lights will need retouching at all; but if it is flat or weak, the highest points may be strengthened, and, as the rest of the negative is untouched, it is easy to keep them exactly of the same nature and position as they would have been had more contrast existed previously. For remember always to keep the *centres* (highest points of intensity) of light in their proper places.

The remaining high-lights should then be attended to in the order of their density, and not according to their position, and all this should be done before the half-tones or shadows are touched, so that all the features are retouched methodically part by part. The half-tones are next attended to, commencing with those which will print lightest, and working with the others successively until the shadows are reached in turn and worked off in the same order. By working thus, the balances and centres of light and shade may be kept throughout, and only defects will be obliterated, whilst the modelling and character detail are retained with ease.—" B.J.," August 18, 1905, p. 645.

Demachy recommends the use of the roulette and scraper knives for retouching negatives, and states that they are much easier to use than the ordinary scalpel, and that the density may be locally reduced without any loss of structure.—" Rev. Phot.," April, 1905, p. 97.

Film Photography.

NEGATIVES ON FLEXIBLE SUPPORTS.

Calotype in Modern Form.—Dr. C. Sturenberg gives details of Talbot's " Calotype " as worked by him.

Iodising the Paper.—Immerse sheets of paper for five or six minutes in:—A. Silver nitrate 15 gms., water 500 c. cs., and hang up to dry. Then immerse in:—B. Potass iodide 30 gms., water 300 c. cs., for five or six minutes, and dry. After washing in clean water, the paper can be dried by heat in its insensitive state, and keeps for a long time.

Sensitising.—A. Silver nitrate, 6 gms.; distilled water, 60 c. cs.; acetic acid fort, 10 c. cs. B. Saturated solution of gallic acid in water (= 1 to 2 per cent.). Mix A. and B. in equal parts, and brush over the iodised paper, allowing the coating a minute or two to sink in, and again brushing over. Wash and dry, these and other operations being done in the dark room, or the paper can be exposed wet and unwashed. It is about as rapid as wet collodion. The developer is saturated solution of gallic acid *plus* a little acidulated silver nitrate solution. The more of this latter, the pluckier the negative. A little acetic acid is added to the developer in cases of over-exposure. The fixing bath is 10 per cent. hypo solution, which is used for fifteen minutes, after which the prints are washed for two hours or less.

For softer negatives, the B. iodising solution is replaced by:—Potass iodide, 24 gms.; potass bromide, 8 gms.; water, 500 c. cs. Two to three grammes of citric acid in place of acetic acid in the sensitiser gives a more stable paper, and the lights of the negative are clearer.

Negatives by the process are very sharp, and free from halation, owing to the yellow colour of the iodide and the penetration of the sensitive substances into the paper. The author proceeds to the making of negatives on commercial gelatino-bromide paper. —"Rev. Suisse," November, 1904, p. 480.

Bromide Paper Negative Work.—The employment of ordinary bromide paper for making negatives is recommended by W. Easton. Wellington "Smooth" is the grade specially mentioned, and making contact negatives from enlarged transparencies (also on bromide paper) is advocated. For outdoor work an exposure meter is suggested, and the paper negatives are developed without previous soaking in:—

A.	Pyrogallic acid	1 ounce
	Sodium sulphite	2 ounces
	Citric acid	15 grains
	Water	$9\frac{1}{4}$ ounces
B.	Sodium carbonate	4 ,,
	Sodium sulphite	4 ,,
	Water	1 quart

Half an ounce of A. is mixed with five ounces of B. for use, and it can be employed a second time, but will not keep longer. The fixed bath is made up of—

Hypo	4 ounces
Potassium meta-bisulphite	40 grains
Water	1 pint

and the negative left in this for a quarter of an hour, then

washed and dried in the ordinary way. The negative should be developed until black all over, to give good printing quality. Waxing the negatives is accomplished by immersing them film down (and previously warmed in front of a fire), into a tin dish full of melted wax. A pound of paraffin candles, with the wicks removed, answers the purpose, and the melted wax should be brought to the temperature of boiling water before inserting the negatives. After soaking for 5 minutes they are lifted out and drained, placed between two pieces of packing-paper, and a hot laundry iron passed over them. This is repeated between two more pieces of packing-paper, and then between clean blotting-paper to remove all excess of wax. The negative is then ready for printing. Working on the negative should be done before waxing. To disguise the grain when making contact negative from large unwaxed paper transparency, printing under tissue paper is recommended; magnesium ribbon can then be employed. —"Phot.," January 9, 1905, p. 110.

Packing Roll Films.—Herr Schulze draws attention to the case of some roll films sent to him from South America. To preserve them from the damp and the deleterious action of the atmosphere they were sorted into series, packed in tin cases, and soldered down. Upon opening the first case the lid was blown off, with a loud report, across the room, and the roll of films which was enclosed caught fire. Possibly the celluloid, upon which the emulsion was spread, generated fumes by the heat applied to the box when it was soldered down. These could not escape, and when the box was opened the friction ignited the gas and caused an explosion, because of the smallness of the hole through which the gas escaped into contact with the air. From this it appears that the boxes in which films are packed should not be soldered, and that it is preferable to enclose them in a second outer case, which may then be soldered down in the usual manner.—"B.J.," November 11, 1904, p. 962.

V.—PRINTING PROCESSES.

POSITIVES DIRECT.

Pigment Positives.—E. Constet exposes the plate in the usual way, develops in ferrous oxalate (not pyro or other developer that has no gelatine), and after a rinse places in water, 100 c.c.s.; hydrochloric acid, 10 c.c.s.; to which is added at the time of use barium peroxide, 4 gms. This can be done in ordinary daylight. The silver deposit and the gelatine associated with it is removed, the process being completed by very gentle pressure with the finger. The resulting positive relief is now stained with any suitable dye.—"Phot. Rev.," December 25, 1904, p. 202.

Producing "Ambrotypes" with Gelatine Plates.—Mercurially treated images produced with a plain iodised collodion sensitised

in nitrate of silver, and developed with pyrogallic acid, give when backed with black material positive pictures known as ambrotypes. A. J. Jarman describes how similar positives may be obtained with gelatine plates. A plate of medium rapidity rich in silver is suitable. A short exposure only is necessary, and the development is not carried so far as is necessary for a negative. The developer recommended is:—

A.	Potassium oxalate	6 ounces
	Oxalic acid	20 grains
	Warm water	30 ounces
B.	Protosulphate of iron	6 ounces
	Sulphuric acid	20 drops
	Cold water	30 ounces
C.	Bromide of potassium	½ ounce
	Water	10 ounces

Take 4 ozs. of A., 1 oz. of B., and 3 or 4 drops of C., for use. An alternative formula is:—

Metol	50 grains
Hydroquinone	50 ,,
Warm water	30 ounces
Sulphite sodium	240 grains
Carbonate sodium	150 ,,

After devlopment fix in hypo 4 ozs., water 20 ozs., rinse, alum and thoroughly wash the plate. Then whiten the image in—

Mercury bichloride	100 grains
Ammonium chloride	100 ,,
Distilled water	15 ounces

Dissolve by aid of heat, and add 15 ozs. more of water, and filter.

When the image is bleached, well wash and dry. Then back the plate (film side) with a varnish made of—

Lamp black	1 ounce
Wood alcohol	5 ounces
Shellac varnish	2 ,,
Venice turpentine	½ ounce

This should be made at least six hours before using. If too thick, add more wood alcohol.—"Wilson's," June, 1905, p. 250-3.

Positives Direct by Phosphorescent Printing.—J. Hort Player obtains positives direct "by phosphorescent light, latent on a phosphorescent surface, and rendered active by heat." The process is as follows:—

1. Prepare a phosphorescent surface by coating with luminous calcium sulphide a sheet of paper uniformly translucent.

2. Take this prosphorescent surface, and expose it for some 10 to 20 seconds to full daylight, or until in a dark room it glows with a bluish light.

3. Place the paper with the luminous surface downwards on the picture to be copied, laid perfectly flat on a sheet of glass, ensuring uniform contact between the two by means of a sheet of plate glass.

4. In an otherwise darkened room illuminate uniformly and strongly with yellow light (gas light is sufficiently yellow) for from 5 to 10 minutes, allowing the light to pass through the phosphorescent paper on to the picture.

5. Remove the now only very faintly luminous paper and place it in a frame in contact with a sheet of bromide paper, extra rapid, the phosphorescent surface face to face with the sensitive surface.

6. Place the frame containing the two papers (ensuring of course the exclusion of outside light), in a box, and heat them lying face to face for from 20 to 30 minutes, raising the temperature to about 120 degrees F. Finally develop and fix in the usual way.—"Phot. Journ.," November, 1904, p. 303.

Photegie.—Coustet suggests, under this name, the following process for obtaining direct positives, reversed duplicate negatives, as well as colour photographs. An ordinary negative, which must not be developed with pyro, is developed till the deepest shadows are visible on the back of the plate, and then thoroughly washed. The following operations can be performed in daylight. A solution is prepared :—

Water	1000 c.c.s.
Hydrochloric acid	100 ,,
Barium peroxide	50 gms.

Add the acid to the water, place the bottle in a vessel of cold water to keep it cool, and add the barium gradually, with constant stirring. In this solution the negative is immersed and the dish rocked, when the gelatine and silver image will dissolve. As soon as this is complete the plate should be placed in cold water, and if any traces of an image are left they may be removed by gently rubbing. The result is a plate which bears an image composed of various thicknesses of gelatine and unaltered silver haloid, and the latter can now be fixed out and the gelatine dyed with any dye, or it can be developed. For making duplicate negatives a positive must be used.—"Phot Gaz.," June, 1905.

The Capacity of Different Printing Processes for Rendering Gradations.

William Goodwin, in a paper before the Glasgow and West of Scotland Amateur Photographic Association, records the result of examining printing papers in respect of the length of gradation permitted by them. The test exposures were made through graduated scales of white tracing paper so built up that the doubled at every second layer, any departure of the screen from this rule being tested by exposure of bromide papers through different parts of the scale for the proportionate times.

Examined by the number of tints they would register under a screen or scale, such as the above, papers of the gelatine P.O.P.

class, were found to differ greatly. Some registered 1 to 15, and others 1 to 20 tints, representing opacities of 1 to 64, and 1 to 256.

The gradation in all printing-out papers presents a certain important peculiarity. Examination shows that there is a gradual decrease in the steepness of gradation towards the shadow end, which becomes very marked in the deeper tones, where the difference between any two contiguous exposures becomes hardly perceptible. The explanation is simple. As the silver compounds darken during printing, the discoloured particles act as a screen to those lying beneath them, so that the darkening of the latter is delayed. The greater the amount of darkening, the greater the screening effect; hence the lighter of two tones tends to overtake its darker neighbour, and the contrast between them is less than the contrast between the corresponding tones of the negative used. The effect of this is to soften the shadows of the print and lengthen the scale of gradation, as will be seen by comparison with other classes of papers where this screening effect does not arise. At the other end of the scale there is also a somewhat abrupt falling off in the gradation not quite so easily explained. It will be noticed that the gradations *print out* clearly enough, but that they disappear, or are disproportionately reduced during toning and fixing. The author ascribes the loss of these delicate tones to the fact that silver chloride prints out more rapidly than the organic silver compounds which are associated with it, and which give richness and depth of colour to the print, hence the lighter tones consist mainly of chloride alone, which is more reduced during toning and fixing than the organic compounds. This seems the more likely, because in these experimental prints the lightest tones—those which suffer most in the after processes—are, when taken from the printing frame, distinctly bluer in colour than the somewhat darker tones adjoining. The conclusion is, therefore, inevitable that printing-out papers cannot possibly give a correct rendering of the negative, although their vast popularity indicates that they give a rendering which pleases the majority of photographers. No doubt the softening in the shadows is rather welcome than otherwise, while the abnormal gradation at the other end of the scale gives a certain sparkle or brilliancy which is equally desired.

It is a peculiarity of the carbon process that its range of gradation is variable at will, over fairly wide limits, by varying the strength of the sensitising bath. An average bath of 4 to 5 per cent. of bichromate will give a range about the same as the majority of the P.O.P.'s, and requires a negative of a considerable range of opacities. If, however, the tissue is sensitised on a bath more diluted, the range of gradation is shortened and rendered much steeper, and the negative may be correspondingly thinner. On the other hand, tissue to suit a negative of extreme contrast may be prepared by sensitising on a bath of greater strength up to about 8 per cent. Beyond that strength trouble arises owing to crystallisation of the bichromate in the film, and even at 8 per cent. is sometimes noticeable.

The gradations obtained were:—

	12 hours after sensitising.	5 days after sensitising.	10 days after sensitising.
8 per cent. bath ...	1 to 64	1 to 96	1 to 128
4 per cent. bath ...	1 to 32	1 to 48	1 to 64
1 per cent. bath ...	1 to 16	1 to 24	1 to 32
½ per cent. bath ...	1 to 8	1 to 15	1 to 16

The tissue was kept in an air-tight tin and the temperature did not exceed 45 degrees during the period of keeping. It is thus seen that range of gradation of carbon tissue improves with keeping under proper conditions.

In the case of platinum paper, the gradation is most uniform in character. Every tone in the negative is rendered in its tone value.

The conditions are different in the case of development papers, where exposure and development can modify the gradation. The author, by direct exposures of a piece of bromide paper—strip by strip—found a range of at least 1 to 96, *i.e.*, starting with exposure of one second a distinct difference was obtainable between those receiving 48 and 96 seconds respectively. Other papers, however, give a much shorter scale than this.

In testing bromide papers, a normal developer was used, consisting of two grains of amidol in each ounce of 5 per cent. sodium sulphite, with two drops of 10 per cent. potass bromide to ensure absence of fog This developer is sufficiently concentrated to give the deepest black the paper is capable of producing, and the amount of bromide is too small to affect the gradation.

Under these conditions, when development is carried to the point at which all further action ceases, the majority of the papers gave seventeen tints, equalling a range gradation in the negative of 1 to 128; one gave a very short range, fourteen tints, equalling 1 to 48 (that is one of the older brands); another gave fifteen tints, equalling 1 to 64; and another sixteen tints, equalling 1 to 96.

Hence most of them are quite capable of dealing with negatives of normal contrast, such as are suited for P.O.P. It has to be noted, however, that bromide paper is subject to rapid falling off in contrast towards the ends of the scale even to a greater extent than P.O.P., and it is doubtful if some of the tints at the ends would be distinguishable from each other if scattered about as in a print.

The author confirms the method of Mr. John Sterry for altering the gradation of bromide prints, viz., to expose for the brightest light of a long scale of gradations, and treat with very dilute chromic acid or bichromate before development.

Amongst "gaslight" papers on the market were found brands giving 1 to 8, 1 to 16, 1 to 25, and one 1 to 64, which equals a slow bromide. These are the gradations of negatives most suitable for the brands of paper, but that is not to say that negatives of longer scale cannot be printed on them. They can be dealt

with by giving full exposure and using a somewhat diluted developer, but as it is necessary to use the whole scale of tones in order to bring out detail in the lights, the prints will be too harsh in contrast. Longer exposures which would bring out the detail at an earlier stage would tend to block up the shadows, while greater dilution of the developer, although it would give a softer result, would injure the colour. On the other hand, a negative within the proper capacity of the paper will give a soft or a brilliant print at will according to the duration of development and the amount of exposure while retaining the pure greys and blacks which are characteristic of the process. A print showing the result of over-development in giving dense and inky shadows is very easy to achieve by the use of a rapid developer. Bromide cannot be used to slow development, as it spoils the colour, nor can dilution be resorted to unless a warmer tone is desired. Prolonged exposure followed by very dilute and restrained development gives warm colours owing to incomplete reduction of the silver, probably with formation of photo-chloride.

Development with excess of bromide and carbonate of ammonia to obtain red tones shortens the scale, but the colour contrast is small, tending to give a flat print.—"B.J.," March 10, p. 187; March 17, p. 207; and March 24, p. 227, 1905.

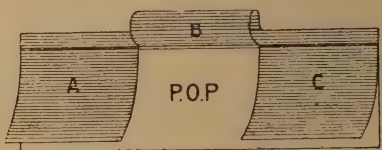
Printing Methods and Accessories.

Printing-in Clouds.—E. R. Human described a process as follows (before the London and Provincial Photographic Association):—For whole-plate negatives, a 12 by 10 frame is chosen, a piece of clear glass placed in it, and the landscape negative upon this, so that about one to one and a-half inches are caught by the hinged back to prevent any movement during examination. A ten by eight frame may be used for half-plates, and a whole-plate one for quarter-plates. If addition is to be made to the length of the sky, a sheet of black, opaque paper is placed at the sky end of the negative to protect the paper from becoming degraded, the printing paper is then put into place, and the frame turned over. A sheet of cardboard is then placed in front, with the edge turned upwards, and the frame put out to print in a diffused light. When sufficiently printed, the operation is reversed, the sky negative taking the place of the landscape, and the printing done as before. The effect of this procedure is that the two printings are so vignetted one into the other that it is impossible for anyone to detect that double printing has been done. For all papers with a visible or semi-visible image, this plan is followed. For carbon work a strip of paper is fastened to the edge of the frame, and marks made thereon, to give the position of the vignettes. In printing bromide, or other papers of that description, the same marks as for carbon are used, and a sheet of cardboard kept on the move for about one and a-half inches to and fro. In enlarging, a sheet of cardboard is kept on the move, as in contact bromide printing, between the lens and the easel.—"B.J.," May 19, 1905, p. 394.

Printing Panoramas.—A. W. H. Weston takes a piece of black paper the length of the panorama required and half an inch wider, and with a sharp knife divides it, as far as the half inch margin, into as many sections as there are negatives, each section being as wide as the portion to be printed from the corresponding negative, and the whole united by the undivided margin.

This black paper is joined to a piece of P.O.P. of the same size by gumming right along the half inch margin. The cuts in the black paper must join up closely when pressed into contact with the P.O.P., and the gum is then allowed to dry.

If there are three negatives to be printed from, the middle flap of black paper, B, should be nearly as wide as the entire view included in the middle negative. This middle negative should be printed from first by turning back the middle flap of black



paper and masking the edges of the negative with the other two flaps, A and C. To join this section, when printed, to the next, turn back all the black paper, and superpose the portion that overlaps on to the next negative by looking through it to a strong lamp-light. Place it in the frame (which, by the way, should be half-plate size or larger, for quarter-plate negatives), fix the springs, and then open one side at a time, and turn down the black paper to mask those portions already printed.

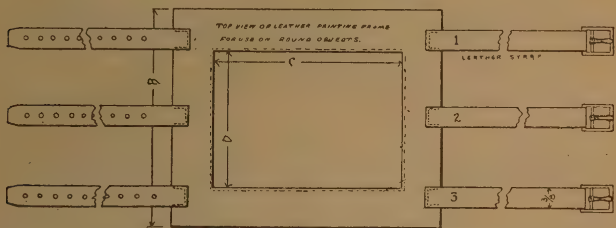
It will be found that owing to the black paper being joined to the print and originally one piece, the joins will only be visible in the print by a fine white line, which can easily be spotted out. —"Pgm.," September, 1905, p. 254.

Vignetting.—C. Ray Woods recommends the method of fixing to the printing frame a piece of card in which an aperture is cut large enough to include all the subject which is to be deeply printed, but no more. Tissue paper is pasted over the opening, and a series of strokes with a brush, of burnt sienna or Venetian red, applied to graduate the spreading of the light beyond. To do this the frame containing the protecting glass and negative should be held face upwards, at an angle of about 30 degrees with the horizontal, and the strokes of the brush applied from underneath. As we cannot actually see the brush through the paper, but only see the strokes made, this is to some extent a matter of feeling; it is surprising, however, to find how soon one gets used to a seemingly difficult task. The first trick of the tyro is to turn the frame over to look at his brush-strokes, and so endanger the safety of the negative, but he soon gets out of this clumsy proceeding.

The proper application of this method to vignettes of various kinds, is dealt with in two subsequent articles.—"B.J.," August 25, September 1 and 8, pp. 665, 684, and 708.

Combination Printing.—Newton Gibson describes a method for printing several figure studies into a single print. It is suited for this purpose, though not for landscape work.—"Pgm.," September, 1905, p. 269.

W. S. Whitcomb describes a method of decorating china bowls and plates, etc. He uses a leather printing frame of special construction, and for printing upon a cylindrical-shaped object, such as a vase or water pitcher, film negatives are necessary. The printing frame is constructed as shown in the cut. The



opening in the centre is slightly smaller than the film used, and the frame is covered with a piece of transparent celluloid stitched on to prevent distortion of the leather. The straps are of sufficient length to go completely round the object, and can be unbuckled one at a time to observe the progress of printing. The surface to be printed upon is coated with a solution made as follows :—

A.	Alcohol	1 oz.
	Ether	1 ,,
	Pyroxyline (gun cotton)	12 grs.
B.	Silver nitrate	60 ,,
	Water	1 dram
C.	Strontium chloride	64 grs.
	Alcohol	2 ozs.
D.	Citric acid	64 grs.
	Alcohol	2 ozs.

Mix thirty minims of B with the whole of A, and add a dram of C and half a dram of D. Shake well after each addition and coat the object intended for printing at once by flowing the solution as prepared over its surface, allowing same to dry thoroughly before proceeding to print. Printing being complete, the object is washed in several changes of water, and then toned in a gold bath, and fixed in hypo. A final wash completes the process.—"Cam. Craft.," May, 1905, p. 264.

Pictorial Printing, by A. Horsley-Hinton and others, is treated at length in "Pract. Phot.," No. 25-36, August-September, 1905.

Plain and Albumen Paper.

Plain Salted Paper for Platinum Toning.—C. A. L. Pearson directs:—Any good linen or drawing-paper may be used. The salting solution, applied with a small, soft sponge, is as follows:—

Water	4 ounces
Gelatine	10 to 40 grains
Sodium chloride	25 ,,

The sensitising solution is:—

Silver nitrate	70 grains
Citric acid	35 ,,
Water to	1 ounce.
Strong ammonia	1 q. s.
Potassium bichromate solution...	4—12 drops

(Water 1 oz., potassium bichromate 10 grs., forms the potassium bichromate solution.) Sufficient ammonia is added to dissolve the precipitate formed by dissolving the citric acid and silver nitrate together in about 2 drachms of water.

The bichromate increases contrasts, and may be omitted for hard negatives.

The paper should be sensitised by means of a Buckles brush, and dried in the dark. Printing is carried further than usual, and the toning bath is composed as follows:—

Dissolve 5 grains oxalic acid in 2 drachms of water, and add 2½ grains of common salt. When the precipitate has subsided, pour off the clear solution, and add water to make one ounce, and 5 to 10 drops of a 15 grain to ounce solution of potassium chloroplatinite. By sufficiently increasing the platinite almost all the silver will be replaced by platinum. In this case print very deeply. Wash in several changes of water after toning, and fix in—

Water	8 ounces
Hypo	1 ounce
Sodium sulphite	60 grains

If tartaric acid is substituted for citric acid in the sensitising solution, the solution may be applied as a single solution sensitiser, for applying to cloth, paper, etc., without previous salting.—"Wilson's," May, 1905, pp. 207, 208.

Toning Arrowroot Paper.—Toning baths for brown to violet tones should be weak, and are best made up half to one hour before use; they will not keep long after addition of the gold.

FORMULÆ.

Borax Bath: Borax, 3 gms.; distilled water, 500 c. cs.; 1 per cent. solution gold chloride, 12 c. cs.

Phosphate Bath: Sodium phosphate, 3 gms.; distilled water, 400 c. cs.; 1 per cent. solution gold chloride, 12 c. cs.

Tungstate Bath: Sodium tungstate, 4 gms.; distilled water, 400 c. cs.; 1 per cent. solution gold chloride, 12 c. cs.

Platinum Bath: Distilled water, 1000 c. cs.; phosphoric acid solution (sp. gr. 1.12), 15 c. cs.; 1 per cent. solution potass chloroplatinite, 100 c. cs.—"Phot. Mitt., II November, 1904, p. 344.

Plain salted paper is dealt with at length in series of editorial articles in the "B.J.," April 28, May 12, May 19, June 2, 1905.

G. Hauser patents a process in which paper or other surface is coated with gelatine containing oxide of zinc, and is then dipped into a solution of silver nitrate or citrate. Fine black tones are obtained by direct printing, and without toning, and hypo does not alter the colour. Under-exposed prints can be developed in the usual way, and the paper can be worked by artificial light.—Fr. Pat., No. 345,206, July 6, 1904.

Namias points out that plain sensitised papers will not keep well, but that if, after silvering, they are immersed in a 5 per cent. solution of oxalic acid, the whole of the free nitrate is converted into oxalate, and that then the papers will keep well. If a mixture of 2 per cent. of oxalic and 4 per cent. of citric acid be used the papers will keep longer still. The mixture of oxalate and chloride of silver gives very vigorous prints, which do not lose much in the subsequent operations of toning and fixing. Before toning, the prints must be immersed in a salt bath and well washed.—"Phot. Rev.," 35, 1905, p. 67.

Albumen Paper.—A series of articles appears in the "B. J.," 1905, June 16, p. 462, July 21, p. 563, August 11, p. 622, and August 25, p. 663.

Gelatine and Collodion P.O.P.

PRINT-OUT EMULSIONS.

Crystalline Deposits in Emulsion.—According to Wardrowsky, nitrates—mostly silver nitrate—separate from collodio-chloride emulsion from various unknown causes, but sometimes when the spirituous solution of citric acid or the final glycerine is added. Emulsion with such crystalline precipitate gives a matt, greasy film. It should be examined by shaking in a small glass-stoppered funnel: in weak daylight the portion in the narrow part of the funnel should be clear. On emptying the funnel by the tap, the film of emulsion left behind should be glass-clear. The author gives a scheme of analysis of the precipitate in an emulsion, and assuming that it consists chiefly of crystalline nitrates, forbids the use of a chloride of a metal (*e.g.*, strontium) whose nitrate is only slightly soluble in alcohol. If such a chloride is used, there must be enough water in the emulsion

to keep it in solution, although for other reasons water is dis advantageous. Hence lithium, calcium, and aluminium chlorides are better, the nitrates of these metals being very soluble.

If there is silver nitrate in the residue, the silver solution has been added too freely or too quickly, or not enough water is present. The silver nitrate should be dissolved in an equal weight of distilled water at 50 degrees C., and four times the volume of warm alcohol 40 degrees C. then added. This mixture is then poured into the chlorised collodion off a glass rod whilst the vessel is actively shaken. Mixed in this way, silver nitrate will not separate.—"Phot. Mitt.," II November, 1904, p. 349.

To convert deposited silver nitrate into citric, Wardrowsky continues:—Ammonia is added in alcoholic solution. It forms ammonium citrate, which then decomposes the nitrate to silver citrate and ammonium nitrate, but it seems that once the formation of silver citrate has been started in this way, the citric acid and silver nitrate will themselves re-act.

Alkaline citrate deposits in the emulsion may arise from alkali in the collodion, which should be tested with phenol-phthalein solution. The citrate solution also may contain almost invisible suspended matter on which, if they are not filtered out, silver citrate will crystallise. Glycerine added "neat" to the emulsion may also give rise to decomposition of silver citrate: it should be mixed with three times its volume of alcohol. Sulphates in the collodion will deposit calcium or strontium sulphate.—"Phot. Mitt.," II December, 1904, p. 380.

Canada Balsam in Collodio-Chloride Emulsion.—Bentzen points out that the usual additions of glycerine and castor oil to collodio-chloride printing-out emulsions cause them to rapidly spoil, and that their omission makes the film brittle and apt to curl in aqueous solutions. He recommends the use of Canada balsam as far superior to glycerine and castor oil. For this purpose it is necessary to purify the balsam, and he finds, contrary to the statement in most handbooks, that it is not entirely soluble in ether: 10 parts of Canada balsam should be dissolved in 50 parts of ether, the solution filtered, and then placed in an open vessel, in a place free from dust, to evaporate. The dried product is dissolved in ether in the proportion of 40:460, and of this 5 per cent. should be added to the collodion emulsion when mixed.—"Phot. Ind.," May 24, 1905, p. 480.

Testing Collodion for Collodion-Chloride Emulsions.—Herr Wandrowsky gives the following method of testing collodion for making printing-out collodion emulsion. It should be free from alkali, as shown by addition of a few drops of a 1 per cent. solution of phenolphthalein; if it becomes reddish violet, even if only faintly, hydrochloric acid should be added drop by drop till this reaction no longer occurs, and the collodion remains colourless. If the proportion of alkali is very great the collodion should be rejected, as it would otherwise give a coarse granular silver chloride. The collodion should be free from sulphates. These may be tested for by the addition of a small quantity of barium chloride—if a white precipitate is formed the collodion

should be rejected. In making a collodion, care should be taken to filter the alcoholic solution of citric acid immediately before using it, as the little fibres may cause the separation of silver citrate. Careless addition of glycerine may also cause precipitation of the emulsion, and therefore it should always be diluted with three times its volume of alcohol, and added in a fine stream and with constant shaking.—"Phot. Mitt.," January, 1905.

TONING P.O.P.

Stale paper, especially collodio-chloride, according to Th. Bentzen, tones much better in the combined bath, and a formula recommended is: Water, 250 c. cs.; ammonium sulphocyanide, 75 gms.; hypo, 5 gms.; ammonium chloride, 40 gms. Five c. cs. of this stock solution are added to 100 c. cs. water, and 5 c. cs. 1 per cent. gold chloride solution added thereto. After toning, they are fixed for ten minutes in 10 per cent. hypo; an acid fixer of this strength is used if the paper has greatly yellowed.—"Phot. Ind.," November 30, 1904, p. 1097.

Thiocarbamide Toning.—Kessler states that for two years this bath has been used with satisfactory results for various kinds of P.O.P., and strongly recommends it on account of the saving of gold, absence of poisonous qualities, and double toning. It was first suggested by Hélain, and modified by Valenta ("Phot. Korr.," November, 1902). The bath is made as follows:—

STOCK SOLUTIONS.

1.	Thiocarbamide...	1 gramme
	Water...	50 c.c.s.
2.	Gold chloride	1 gramme
	Water	100 c.c.s.

For use take, Solution No. 2, 25 c. cs.; and add Solution No. 1, 14—15 c. cs.

This should be added slowly, and with constant stirring. A precipitate is first formed, which gradually re-dissolves. As soon as the solution is clear, the addition of No. 1 may be stopped, and then add—

Citric acid ... ... 0·5 grammes

To this add—

Salt ... ... 10 grammes
Water to ... ... 1000 c. cs.

The prints must be well washed prior to toning, and the bath acts so quickly that it is sometimes advisable to dilute with an equal quantity of water. Blake-Smith ("Phot.," 1903, p. 247) advised the addition of nitric acid. Kessler has found this of no advantage. The temperature of the bath has very little influence on its action.—"Phot. Korr.," January, p. 35; "B.J.," January 13, 1905, p. 28.

Red Tones on Matt Collodion Paper.—Kessler recommends the use of the following bath for obtaining reddish tones on matt collodio-chloride P.O.P.:—

Chalk ... ... 25 grammes
Water... ... ... 1000 c.c.s.

Shake well and add—

Chloride of gold (1% solution) ... ... 10 c.c.s.

Allow to stand for two hours, and use the clear solution. The thiocarbamide bath may also be used if diluted with at least double its volume of water.—"Phot. Korr.," January, 1905, p. 37; "B.J.," January 13, 1905, p. 29.

Violet Tones.—Koehler recommends very deep printing, followed by over-toning in a combined toning and fixing bath till the prints are greyish-yellow, then washing for one hour, and subsequent immersion in a 2 per cent. solution of mercuric chloride. The tone is said to change instantly to a beautiful velvety violet tone. Half an hour's washing completes the process.—"Pharm. Zeit.," 50, 1905, p. 261.

Black and Brown Tones without Toning.—Thuillier recommends the following salting solutions for plain papers, and states that if resin-sized papers are used, black tones are obtained; with starch or gelatine sizes, sepia tones.

For black tones :—

Sodium phosphate	40	gms.
Borax	20	,,
Sodium carbonate	10	,,
Sodium chloride	5	,,
Potassium bichromate	0.01	,,
Water	1000	c.c.s.

The author lays great stress on the fact that the above salts should not have effloresced. The bichromate must be added after all the other salts are dissolved.

For sepia tones :—

Sodium phosphate	20	gms.
Borax	40	,,
Salt	5	,,
Potassium bichromate	.08	,,
Water	1000	c.c.s.

The salts here should have effloresced. The paper should be immersed from 20 to 40 seconds, according to the thickness, and then dried. The sensitising bath consists of :—

Silver nitrate	50	gms.
Lead nitrate	50	,,
Water	1000	c.c.s.

This must be neutralised with soda.—"Phot. Rev.," 1904, p. 277.

Warm Tones by Heat.—Solon Vathis has patented the following process :—Prints are toned with gold chloride and hydrochloric acid, and yellowish brown, reddish violet, blue violet, etc., tones obtained. They are fixed and washed as usual. By heat the tones obtained can be locally or entirely changed, especially to red and yellow, so that starting with blue or violet a series of different colours may be obtained in the one print. To heat the prints, the backs are passed over a Bunsen burner or a heated iron may be applied. The heat may be as high as 530 degrees F., but a change will be seen at 212 degrees. Finally, the prints should be immersed in water for 10 minutes, and then

mounted. The colours obtainable by heating are dependent on the depth of printing, on the tone given by the gold bath, and on the duration of heating. In the faint print in the high lights a pale rose is obtained, in the shadows a bright red, in dark prints the colour is red brown.—Ger. Pat., No. 144,555, January 18, 1902.

Toning P.O.P. after Fixing.—C. Harold Smith recommends the following process for toning without gold. The print may be untoned by gold, in which case it needs to be very deeply printed, or toned by gold, but insufficiently so. In either case the hypo needs to be completely freed from it by washing. The print is then immersed in:—

Ammonium sulphide (strongest commercial solution)	5 drops
Water	20 ozs.

The bath should just faintly smell of the sulphide. Toning takes place fairly quickly, and when complete gives a deep brown print, which is washed for a short time before drying. The colour will not please everyone for P.O.P., but the process has the advantage of making it possible to save a print spoilt by a trace of hypo in the gold toning bath. Fresh P.O.P. works best by this process, in which sodium sulphide may be used in place of the ammonium sulphide solution. From the supposed conversion of the image into silver sulphide, the author believes the process to be permanent, and he states that prints made on Ilford P.O.P. in this way are unchanged after six years. Prints made on Ilford matt P.O.P. after deep printing and simple fixation are of a good sepia tone, very similar to a hypo-alum toned bromide.—"Phot. Scraps," November, 1904, p. 180.

DEVELOPING P.O.P.

Developing Collodio-Chloride Paper.—J. Switkowsky accidentally re-discovers that collodio-chloride P.O.P. can be exposed to magnesium ribbon and then developed. The paper should be placed in the printing frame by artificial light, and not exposed to daylight at all; about 10 c. cs. of magnesium ribbon should be used, and the longer the exposure the brighter the tone of the print. The actual developer used was:—

Adurol	20 grammes
Acetone sulphite	25 ,,
Potassium carbonate...	200 ,,
Water	350 c. cs.

For use dilute 1 oz. of above with 5 ozs. of water.—"Phot. Mitt.," I January, 1905, p. 13.

The Development of Printing-Out Paper.—Professor Namias suggests the following method for developing faintly-printed images on this class of papers:—Four stock solutions are required:—

1. Gallic acid 3 per cent. solution. The whole of the acid will not dissolve and the solution should be well shaken. 2. Sodium acetate 50 per cent. solution. 3. Sodium sulphite 20 per cent. solution. 4. Metol 2 per cent. dissolved in some of No. 3.

The actual developer is—No. 1 solution, 30 c.c.s. ; No. 2 solution, 10 c.c.s. ; No. 3 solution, 10 c.c.s. ; No. 4 solution, 10 c.c.s.

When mixed add—

Alum	1 grammes
Acetic acid	10 c.c.s.
Water to	250—300 c.c.s.

After development well wash and tone in—

Citric acid	10 gramme
Salt	10 ,,
Chloride of gold, 1 % solution	50 c.c.s.
Potassium chloroplatinite, 1 % solution...	50 ,,
Water	1000 ,,

—"Il. Prog. Foto.," March, 1905, p. 42.

Developing P.O.P.—Schmidt has experimented with various new combinations of developers for developing faintly-printed P.O.P., and the following tables are a summary of his results :—

ORIGINAL DEVELOPER 50 C.C.S. 1 : 1000 METOL SOLUTION.

Additions.	Development.	Tone.	Remarks.
1. Glacial acetic acid, 3 c.c.s.	Quick	Olive	Addition of 5 c.c.s.; 1:20 chrome alum solution gives more brilliant tone. Excellent.
2. Lead acetate...	,,	,,	Nitrate may be used. Advisable.
3. Citric acid (1 : 5), 5 c.c.s....	Medium	Brown	As No. 1. Excellent.
4. Oxalic acid sat. sol., 10 drops.	Slow	,,	Worth trial.
5. Tartaric acid sat. sol., 3-5 c.c.s.	,,	Yellow or yellow brown	As No. 1.
6. Acetic acid, citric acid (a little), chrome alum.	,,	Brownish red	Very good.
7. Citric acid (1 : 5), 5 c.c.s. ; sodium oxalate.	Medium	Greenish olive	Excellent.
8. Bichromate (1 : 50), 2-3 drops.	Quick	Brown	Good.
9. Phosphoric acid (15 p.c.), 10 drops.	Very quick	Dark green	Sodium phosphate can be used (for artistic work).

ORIGINAL DEVELOPER 50 C.C.S. PYRO SOL. 1 : 1000

Additions.	Development.	Tone.	Remarks.
1. Nil	Medium	Yellow brown	The same with 5-10 drops of acetone added.
2. Glacial acetic acid, 3 drops	Slow	,,	The same with citric acid added.
3. Glacial acetic acid, 4 drops; chrome alum 8-10 drops.	Medium	Bright brown	Good.
4. Glacial acetic acid, 5 c.c.s.; citric acid sol. (1-5) 5 c.c.s.; potass bichrom. (1:50), 3-5 drops.	,,	Chocolate brown	Very good.
5. Glacial acetic acid, 10 drops; potass bichrom. (1:50 3 drops.	Very quick	Olive	Good.
6. Citric acid sol. (1:5), 5 c.c.s.; potass bichrom. (1:50), 3 5 drops.	Quick	Greenish olive	Very good.
7. Oxalic acid sat. sol., 5 c.c.s.; potass bichrom. (1:50), 3-5 drops.	,,	Sea-green	Good
8. Copper citrate sol., 5 c.c.s.	Medium	Olive	For artistic work.

ORIGINAL DEVELOPER 50 C.C.S. HYDROQUINONE SOLUTION 1 : 100

Addition.	Development.	Tone.	Remarks.
1. Nil	Very slow	Yellow brown	
2. Acetone, 5 drops	Slow	Brown	More acetone pure browns. Good.
3. Potass bichrom., 3 drops	,,	Bright brown	Wash before fixing.
4. Potass bichrom., 6-10 drops; citric acid sol. (1:5), 10 c.c.s.	Very slow	Dark carmine	For artistic purposes.
5. Phosphoric acid (15 per cent.), 3 drops.	Slow	Brown	Very good.
6. Phosphoric acid, 20 drops	,,	Grey green	,,
7. Copper citrate sol., 10-15 c.c.s.	,,	Olive	Chrome alum gives greater brilliancy. Very commendable.

The copper citrate solution mentioned above is:—

Copper sulphate	10 gms.
Potassium citrate	50 ,,
Water	1000 c.c.s.

—"Phot. Kunst.," June-July, 1905; "B.J.," August 18, 1905, p. 646.

Dr. A. Woolsey Blacklock gives a developer for P.O.P. as follows:—

A.	Pyrogallic acid	32 grs.
	Tartaric acid	32 ,,
	Water	16 ozs.

This solution will keep for three or four weeks.

B.	Potass bichromate	1-16th gr.
	Water	16 ozs.

This solution will keep for several months. The easiest way of making it is to make a stock solution, 1 gr. to 1 oz., and add ½ drachm of it to 16 oz. of water.

Equal parts of A and B are mixed immediately before use, and will develop two or three prints in succession before becoming discoloured.

Fixing bath: Hypo, 1 oz.; acetate of lead, 60 grs.; water, 6 ozs. The prints lose very little in this bath, and are of a fine sepia tint. The printed part of the picture appears to lose more in fixing than the developed part.—"B.J.," October 20, 1906, p. 826.

SELF-TONING PAPERS.

E. C. Morgan describes as follows his patented method of preparing a self-toning paper:—The paper or other suitable material is coated with a warm, sensitive emulsion made as follows:—To 24 ozs. of water add 1½ ozs. of arrowroot or other suitable starch and boil. Dissolve in this mixture when cool: Sugar, 6 drachms; citric acid, 5 drachms; ammonium chloride, 64 grs.; Rochelle salt, 4 drachms; and mix thoroughly. Add slowly 9 drachms 36 grs. of nitrate of silver dissolved in 8 ozs. of water. Next add slowly 11 grs. of chloride of gold dissolved in 6 ozs. of water. Finally take agar-agar 2 drachms, boiled till dissolved, in 18 ozs. of water, and add warm to above mixture. Dry the coated paper, or other suitable material, in a dark chamber. The sensitive paper or material may then be printed by exposure to light under a photographic negative in the usual manner, until a visible image of sufficient strength is obtained. If a print of a purple-brown tone is required the printed paper, or other material, is first washed for about ten minutes in running water, and is then fixed and toned in one operation by immersion for about fifteen minutes in a bath of hyposulphite of soda solution containing about 20 ozs. of hyposulphite of soda to 100 ozs. of water. If a deeper purple-toned print is required, before washing or using the hyposulphite of soda bath the print is immersed for fifteen minutes in a bath containing chloride of

sodium 20 ozs., water 100 ozs. The reason for using agar-agar and arrowroot or other suitable starch as a medium in which to carry the light-sensitive salts instead of the usual vehicles, which are gelatine or collodion, is because, when gelatine is used the gold salt is not so easily reduced, and will not give such satisfactory tones by immersion in hyposulphite of soda solutions only, while collodion as a vehicle is more costly.—Eng. Pat., No. 26,247, 1904; "B.J.," February 3, 1905, p. 92.

VARIOUS PRINT-OUT PROCESSES.

Agar-Agar Process.—J. H. P. Collard and H. H. Molyneux thus describe their paper made with agar-agar and starch as the vehicle of the silver salt. The mixture is prepared by dissolving in 4 ozs. of water, by heat or boiling, about 100 grs. of starch, and mixing with this solution, a solution of agar-agar obtained by boiling 18 grs. of the agar-agar in 2½ ozs. of water. A little sugar, mannite, glycerine or analogous sugar-like substance may be added to the above mixture when a rather soft coating is desired. About 30 grs. of the sugar-like substance to the above quantity is a desirable amount. This preparation, in its non-sensitised state, may then be used to coat the paper or other material which is subsequently sensitised. The coating mixture for a self-toning paper contains: Starch, 1½ drachms, dissolved in 3½ ozs. of water; sugar, 30 grs.; citric acid, 35 grs.; ammonium chloride, 8 grs., and Rochelle salt, 30 grs. To this mixture, after cooling, is added 72 grs. of silver nitrate dissolved in 1 oz. of water, 80 minims of gold chloride solution (of strength 1 gr. per drachm) with 5 drachms of water. Agar-agar, 13 grs., is finally dissolved in 2¼ ozs. of water, is then stirred, and the paper coated in the usual way. For the ordinary print-out emulsion the above preparation, minus the gold chloride, is employed.—Eng. Pat., No. 25,897, 1904.

Silver Phosphate Emulsions.—Valenta points out that he had in 1900 described the preparation of silver phosphate emulsions, which gave such a long range of gradation that only very hard negatives could be used, unless a chromate was added, or they were mixed with hard-working silver chloride emulsions. A further improvement is now suggested, and the emulsions give brilliant prints which are specially suitable for acid development. To 1500 c. cs. of 3 to 3½ per cent. raw collodion, add 20 c. cs. of 20 per cent. phosphoric acid and 60 gms. of citric acid dissolved in 100 c. cs. of alcohol. To this should be added 60 to 80 gms. of silver nitrate dissolved in liquid ammonia fort .880, till a clear solution is obtained, and to which is added 250 c. cs. of absolute alcohol. Finally, 250 c. cs. of ether should be added, and the emulsion filtered, and then 20 c. cs. of glycerine-alcohol 1 :1 added. If coated on matt baryta paper, this gives a fine matt surface, which, if printed till the outlines are just visible, can be developed in the usual metol and glacial acetic acid developer. After thorough washing, the prints can be toned in the usual phosphoric-platinum bath, and give excellent brown to black tones.—"Phot. Korr.," July, 1905, p. 312.

PRINT-OUT GUM-SILVER PAPER.

Dr. Reiss suggests the use of an emulsion of gum arabic and silver nitrate for printing out. A well-sized paper must be used; the well-known Canson's drawing-paper, or good English writing-paper, is found satisfactory.

To make the emulsion, 100 gms. of powdered gum arabic are dissolved in 100 c. cs. of water; of this solution 5 gms. should be placed in a small porcelain or glass mortar, and 3 c. cs. of glacial acetic acid added. The gum is coagulated at once, but on rubbing up vigorously a perfectly homogeneous mass or emulsion can be obtained. To this, then, is added, by yellow light, a solution of 1 gm. of silver nitrate in 3 c. cs. of water, and the mixture again worked up into a homogeneous emulsion.

To sensitise the paper, it should be fastened to a sheet of stout cardboard or a drawing-board, and the emulsion spread over it with a round, stiff hog's-hair brush and the marks evened out with a flat hog's-hair brush. Too soft a brush soaks up too much emulsion. It is important to ensure a regular coating, to coat quickly, and to keep the brushes very clean; after each time of using they must be repeatedly washed in hot water.

The quantity of emulsion required to coat a sheet 18 by 24 cm. is about 3 c. cs. The coated paper should be suspended by a corner, and will completely dry in from ten to fifteen minutes in a well-ventilated and cold room. It is of course unnecessary to add that the operations must be carried out by artificial light, or in a room illuminated by yellow light.

As soon as dry, the paper should be printed. The prepared side is shiny and possesses a faint yellow tinge; it can be kept from twenty-four to forty-eight hours before printing, but it then becomes rather deeper coloured, but this disappears in fixing. If the paper is kept longer, the colouration deepens in ratio to the time it is kept.

Printing is effected in the usual way, and the sensitiveness of the paper varies with the nature of the paper and the time the paper has been kept. Canson's paper prints more rapidly than the English writing-paper. The quality of the paper has not only an influence on its sensitiveness, but it also determines the tone of the print. Whilst the one prints in a red bistre, the other prints to a brown. The sensitiveness of the argentic gum paper is practically the same as that of Lumière citrate paper.

It is obvious that the variation in the colour of the print and in its sensitiveness is greatly dependent upon the size that is used, and an animal sized paper such as English writing-paper may give a totally different result to a resin-sized paper, such as Canson's probably is.

Printing must be carried further than is required in the finished print, as there is a reduction of intensity in toning and fixing. Freshly prepared paper gives the best results with plucky negatives. Soft negatives, however, give equally satisfactory results. After printing the whites of the print should have a faint brownish orange tint.

After printing the print is immersed in ordinary water, and

the whites become quite clear; washing should be continued for fifteen minutes in running water. The print should be immersed in a 2 per cent. solution of hypo for ten minutes, and it should then be washed for an hour and hung up to dry. When dry the print is a rich brown.

If the ordinary photographic tones are required, then the ordinary methods of toning must be adopted, such as gold or platinum or gold followed by platinum. To obtain prints rivalling platinotypes in colour, Namias's bath should be used:—

Potass chloroplatinite	1 gramme
Distilled water	1000 c. cs.
Pure hydrochloric acid	5 „
Oxalic acid	10 grammes

After toning in this, the print must be washed in running water for fifteen minutes, and then fixed as suggested above.

To obtain pure black tones, the print should be first treated with:—

Borax	10 grammes
Sodium acetate	10 „
Chloride of gold (1 % solution)	50 c. cs.
Water	1000 „

Then well washed and toned in Namias's platinum bath given above.

Violet tones are obtained by printing very deeply and toning after a good preliminary wash in—

Water	1000 c. cs.
Hydrochloric acid (pure)	20 „
Chloride of gold (1 % solution)	50 „

The print is much reduced in this bath.

A very fine blue tone is obtained by treating the fixed and well-washed print with—

Water	1000 c. cs.
Ammonium sulphocyanide...	50 grammes
Chloride of gold (1 % solution)	50 c. cs.

Finally, Dr. Reiss has tried to increase the sensitiveness of the paper by the addition of a little gallic acid, and added three drops of a 1 per cent. solution of gallic acid to the first-mentioned quantity of emulsion. The result was greater sensitiveness, but obviously concurrently less keeping power.—"Bull. Soc. Fr. Phot," November 15, 1904, p. 521; "B.J.," December 16, 1904, p. 1063. See also under "Gum-Bichromate."

Bromide and Gaslight Papers.

Blisters on Bromide Paper.—Harold Baker writes as follows on the cause and cure of blisters in bromide paper:—Blisters in large prints, 20 by 16 and over, are caused by creases in the same during handling in fixing and washing. They do not appear until after fixing, often disappear when the print dries,

but reappear on wetting it for mounting. They enlarge when the print is toned by the "sulphide" method, and at the same time there is yellow stain. A remedy is a bath of spirit, in which the prints are placed direct on coming out of the hypo and in which they remain for about ten minutes. They are then washed in the usual way.—"B.J.," February 17, 1905, p. 124.

Glycerine Development.—Clarence Ponting applies the glycerine method of local development (platinum papers) to bromide and gaslight papers. The print is mopped over with glycerine, and developer then applied as taste dictates. As there is no visible image, the print must first be marked. Remove the back of the printing frame, and, holding the paper firmly, hold the negative up to the yellow light, and roughly sketch the outline of the proposed vignette in fairly bold pencil marks. Then hold the print up to the light and sketch lightly on the front the marks made on the back. These marks are erased with soft rubber when the print is finished and dry. After glycerining the print, developer, neat or mixed with half its bulk of glycerine, is painted on, blotted off, and re-applied until the print is finished.—"Pgm.," December, 1904, p. 320.

"Printing Out" in Bromide Enlargements.—R. H. Baskett describes a method of simultaneously exposing and developing bromide enlargements to facilitate combination printing:—

One ounce of glycerine is poured into one ounce of metol-hydroquinone developer, and well stirred. This is poured into a tea-cup or developing dish, and used with a soft, wide brush. A solution of salt and powdered alum is also required as a stop. The bromide paper is soaked in water, and made to adhere to the easel by means of a mountant of glycerine. The sky part of the landscape negative projected on to the paper is covered with pure glycerine. The landscape part is covered with the glycerine developer. After a few minutes' exposure the lens is covered, and the progress of the print examined by yellow light. More exposure is given if necessary, and the landscape portion is developed right out. It is then gone over with the salt and alum solution to stop further printing. The print is now transferred to water, while the negative is changed for a cloud negative. The print is replaced, and the sky portion is now printed in and developed as before. The complete print can then have a final treatment with developer, and streaks can be removed before the print is finally fixed.—"Phot.," May 16, 1905, p. 471.

Printing very Thin Negatives.—For obtaining plucky prints on bromide paper from extremely thin negatives, "Ladbroke Grove" fixes the negative in a suitable carrier, behind which, and about 3 in. from it, is placed a sheet of glass covered with papier mineral. Behind this is placed a duplex paraffin lamp, with large ground glass globe. The bromide paper is exposed in the camera in the dark slide.—"Phot.," January 31, 1905, p. 170.

Black Marks on Bromides.—Muriel Darton finds that if a piece of cotton wool be well soaked with warm (not hot) water, then thoroughly soaped and rubbed on the prints, that it quickly

removes the markings. It is well to treat the prints with alum before rubbing, and there is no risk of abrasion to the surface if reasonable care be exercised. If it is required to squeegee the prints, care must be taken to thoroughly wash them after the treatment with soap.—"B.J.," October 20, 1905, p. 839.

Adurol as a Developer for Warm Tones on Bromide Paper.

Thos. Kitto advocates the following formula:—

Sulphite of soda	4 ozs.
Carbonale of potash	3 ,,
Warm water	10 ,,

When dissolved add—

Adurol	½ oz.

Three other solutions are necessary for the production of warm tones. They are:—

10 per cent. solution of potassium bromide.
10 per cent. solution of ammonium bromide.
10 per cent. solution of ammonium carbonate.

The following table gives the proportions of exposures and developer necessary:—

Exposure.	Concentrated Adurol Sol.	Water.	Potass Bromide 10 p.c.	Ammonium Bromide 10 p.c.	Carbonate Ammonium 10 p.c.	Colours obtained	Time of Development (Approx). accord'ng to temp.
Normal ...	1 oz.	10 ozs.	—	—	—	Black	1 min.
,, + ¼...	1 oz.	10 ozs.	10 m.	—	—	Warm Black	1½ ,,
,, + ½ ...	1 oz.	15 ozs.	20 ,,	—	—	Cool Sepia	2 ,,
Twice Normal	1 oz.	20 ozs.	40 ,,	—	—	Sepia	2½ ,,
Three times...	1 oz.	30 ozs.	60 ,,	—	—	Warm Sepia	3 ,,
Four times ...	1 oz.	40 ozs.	80 ,,	—	—	Bronze Brown	4 to 5 min
Twice Normal	1 oz.	20 ozs.	50 ,,	50 m.	50 m.	Brown	5 min.
Three times...	1 oz.	30 ozs.	50 ,,	100 ,,	100 ,,	Warm Purplish Brown	10 ,,
Six times ...	1 oz.	60 ozs.	50 ,,	150 ,,	150 ,,	Red Brown	12 ,,
Ten times ...	1 oz.	100 ozs.	50 ,,	180 ,,	180 ,,	Red	15 min. to half an hour.
Fifteen times	1 oz.	100 ozs.	50 ,,	200 ,,	200 ,,	Red	15 min. to half an hour.

—"B.M.," April, 1905.

Rapid Chloride Emulsion.—Lüppo-Cramer has endeavoured to obtain silver chloride emulsions as rapid as bromide. Finding

that the usual method with ammonia caused fog, he used the following formula:—

Gelatine	10 gms.
Salt	7 ,,
Hydrochloric acid (sp. gr. 1.9)	10 c.c.s.
Water	160 ,,

Heat to 176 deg. F., and add—

Silver nitrate	10 gms.
Water	100 c.c.s.

also heated to the same temperature. The emulsion was boiled for a quarter of an hour, and then treated as usual. A homogeneous emulsion of fairly fine grain was obtained, and the speed was about three times that of the commercial chloro-bromide emulsions.—"Eder's Jahrbuch," 1905, p. 59.

GASLIGHT PAPERS.

Warm Tones.—Leopold Löbel gives the following formulæ and tables:—

HYDROQUINONE.

Boiled water	1000 c.c.s.
Sodium sulphite (cryst.)	125 gms.
Hydroquinone	15 ,,
Sodium carbonate (cryst.)	250 ,,
Potassium bromide	10 ,,

EDINOL.

Water	1000 c.c.s.
Acetone sulphite...	50 gms.
Edinol	10 ,,
Sodium carbonate (cryst.)	35 ,,

Tone of the dry print.	Exposure.	One part Hydro. devel. to be diluted with	One part Edinol to be diluted with
Blue black ...	Normal ...	undiluted ...	8 parts water + 0.3 parts potass. carb.
Green black ...	Normal ...	5 parts water	9 parts water.
Olive green ...	Twice normal	5 ,, ,,	
Sepia	Three times normal	10 ,, ,,	9 parts water + 0.3 parts conc. sol. of acetone sulphite or .15 dry acetone sulphite.
Brown	Four times normal	10 ,, ,,	
Red brown ...	Six times normal	20 ,, ,,	
Yellow brown ...	Eight times normal	20 ,, ,,	
Blood red	Nine times normal	30 ,, ,,	50 parts water + dry acetone sulphite 0.5 parts.
Red orange ...	Ten times normal	30 ,, ,,	
Yellow	Twenty times normal	40 ,, ,,	

—"B.J.," December 2, 1904, p. 1031.

Opal glass in the dark-room lamp makes a safe light for development of gaslight papers in direct light at close quarters.—"Pgm.," January, 1905, p. 23.

Brown Tones on Gaslight Emulsions.—Dr. Eichengrün points out that a series of tones from brownish black and yellow brown can be obtained by giving from three to six times normal exposure and developing with :—

Edinol	10 gms.
Acetone sulphite	50 „
Sodium carbonate	35 „
Water	1000 c.c.s.

He also states that by this method prints which would otherwise be grey and foggy, are saved, and ascribes this to the peculiar action of the acetone sulphite.

Eichengrün made some experiments with a developer containing no alkali, and was enabled to give normal exposure and obtain fine, brown tones, and if the exposure was increased, redder tones were obtained. The actual developer used was :—

Edinol	10 gms.
Sodium sulphite cryst.	100 „
Water...	1000 c.c.s.

Increasing the sulphite to 25 per cent. fixing takes place, so that subsequent fixing is not required (?). Experiments were tried with all the other developers, but the acetone sulphite formula appears to be the best, and the tone seems to be dependent on the peculiar property of the acetone sulphite. Eder has pointed out (Eder's "Jahrbuch," 1904, p. 82) that acetone sulphite is an acid salt, and that precisely the same restraining results may be obtained by using an acidulated solution of ordinary sulphite. Eichengrün, probably recalling this, has tried the effect of using an equivalent quantity of sodium sulphite, and although the same tone is obtained, yet development is much longer, taking 8 instead of 2½ minutes, but on the addition of the equivalent amount of acetone, black tones are secured. For gaslight plates the author recommends increasing the quantity of the sulphite in above formula four times.—"Phot. Woch.," April 4, 1905, p. 129, from the Berichte d. v. Internat. Kongress. für Angew. Chemie, Berlin.

Permanence of Warm Tones.—R. E. Leisegang criticises Baeklandt's statement that warm tones obtained by development on chloride and chloro-bromide papers are not stable. On papers of the Velox type, hydroquinone-carbonate *plus* bromide will give warm tones up to red and yellow, whilst the same papers give a pure black tone with metol-hydroquinone and other developers. But the warm tones are far less intense, and hence, less stable. With such papers the intensity cannot be increased without veiling the whites, but with other emulsions, such as that of Pan paper, this can be done, and prints so made, of yellow colour, have lasted six years.—"Bull. Soc. Fr. Phot.," November 15, 1904, p. 588.

Warm Tones on Gaslight Paper.—Clarence Ponting uses the following formulæ :—A. solution (developer), metol-hydroquinone,

the usual M.Q., or Mequin formula. B. solution, ammonium bromide 1 oz., ammonium carbonate 1 oz., and water to 20 ozs.

Colour.	Exposure. Times necessary for black tones.	Developer.
Cool to warm sepias	5 to 6	A. 1 oz.; B. 1 dram; water to 3 ozs.
Warm brown to red	6 to 8	A. 1 oz.; B ¼ oz.; water to 4 ozs.
Red chalk ...	8 to 10	A. 3 ozs.; B. ½ oz.; water to 8 ozs.

The high-lights remain clear, even when developing for the longer times. No notice should be taken of the appearance in the hypo bath, as the final colour is not reached until the print is dry.—"Pgm.," August, 1905, p. 229.

Brown Tones on Gaslight Papers.—Eichengrün suggests the following developer for obtaining brown engraving tones on gaslight papers, with an increase of exposure from 3 to 6 times:—

Edinol	1 gm.
Acetone sulphite	5 gms.
Sodium carbonate	3.5 ,,
Water	1000 c.c.s.

It is stated that if the exposure is increased to 10-12 times normal, there is no blocking up of the shadows, and full details with pure whites are obtained. The author also states that the following developer will give brown tones, without any over-exposure:—

Edinol	10 gms.
Sodium sulphite	100 ,,
Water	1000 c.c.s.

If the quantity of sulphite is doubled and exposure doubled reddish tones are obtained.—"Bull Assoc. Belge," September, 1905, p. 296.

Pen Gwylliam describes his method of obtaining warm tones on Rotox (gaslight) papers.

The developer recommended is—

Distilled water	1 oz.
Sodium sulphite	55 grs.
Hydroquinone	7 ,,
Potass bromide	4½ ,,
Sodium carbonate	120 ,,

Dissolved in order given.

This developer, with normal exposure, gives greenish black tones. By increasing the exposure, and simply diluting the developer with water in following proportions, the specified tones are obtained:—

Tone.	Exposure.	Developer Dilution.
Greenish black	1	1 : 5
Olive	2	1 : 5
Sepia	3	1 : 10
Brown	4	1 : 10
Red-brown	6	1 : 20
Yellow-brown	8	1 : 20
Red	5	1 : 30
Orange	10	1 : 30
Yellow	20	1 : 40

—"B.M.," August, 1905, p. 139-40.

SULPHIDE TONING OF BROMIDES AND GASLIGHT PRINTS.

Hypo-Alum and Sulphide Toning.—J. B. B. Wellington warns those using this process against the access of the sulphide vapours to plates, papers, and films; plates developing with irridescent stain and general fog; bromide and gaslight papers giving flat and dirty prints; and P.O.P. assuming a metallic lustre on its surface and refusing to tone.—"B.J.," June 9, 1905, p. 443.

Hypo-Alum Toning.—A supplement on N. P. G. Matt. (III) bromide paper appears in "Phot. Korr.," November, 1904. A superb warm sepia tone is obtained thus:—Prints, developed with ferrous oxalate, are well fixed and washed. The toning bath is as follows: Hypo, 50 gms.; hot distilled water, 300 c. cs., to which 5 gms. of powdered alum are added; with 1½ to 2 c. cs. of a 10 per cent. solution of silver nitrate. This addition is needed only with a new, fresh bath, to diminish the rapidity of action. Heat the fresh bath two or three times to 122 degrees or 140 degrees F., allowing it to cool after each application of heat. The solution should have a temperature of from 100 degrees to 120 degrees F. for use. Toning occupies from 15 to 20 minutes, but the time is more prolonged with cooler solutions. Any deposit should be removed from the prints with a brush or pledget of cotton wool. A preparatory bath of 20 gms. of common salt per 200 c. cs. of water at 70 degrees F. will produce redder tones. Prints which have to be developed with organic developers, such as metol-hydroquinone, show a great tendency to reddish-brown in toning. Old baths, before further use, should be freshened by the addition of an equal quantity of new toning solution.—"B.J.," December 2, 1904, p. 1022.

Various Toning Processes.

Toning Bromides in two Colours.—C. Winthrope Somerville suggests a simple method of obtaining two colours on a bromide print of a suitable subject. He suggests a flower study, such as a dark chrysanthemum, photographed with a white background. The flower is carefully painted over, and bleached with the following solution, applied with a sable brush:—

Potassium ferricyanide...	10 grs.
Potassium bromide	15 ,,
Water	1 oz.

Wash for five minutes and re-develop in—

Sodium sulphide	10 grs.
Water	1 oz.

The flower is thus toned brown. The print is again washed and toned in—

Oxalic acid (saturated solution)	120 minims
Potassium ferricyanide	2 grs.
Ferric chloride	1 gr.
Ferric oxalate	1½ grs.

Vanadium chloride dissolved in hot

Hydrochloric acid	2 grs.
Water	6 ozs.

The remainder of the image turns blue in this. The blue colour becomes green in the subsequent washing.

The brilliancy of this green tone may be reduced from an emerald green to an olive tint by prolonged washing, and may be discharged altogether, but is recoverable by the application of a very weak solution of nitric acid, about 1 in 1000. The print now shows a brown flower with green stem and leaves, etc.

These colours are stated to be permanent.—"A.P.," April 11, 1905, p. 292.

Toning with Lead and Cobalt.—MM. Lumière and Seyewetz suggested the following process for obtaining green tones on bromide prints:—Immerse the deeply-developed print in

Potassium ferricyanide	60 gms.
Lead nitrate	40 ,,
Water	1000 c.c.s.

till bleached, wash well, and then immerse in—

Cobalt chloride	100 gms.
Hydrochloric acid	300 c.c.s.
Water	1000 ,,

when a bright green colour will be the result. A quantitative analysis of the resulting image showed that there was a considerable proportion of silver chloride left in the image, which would therefore not be stable.—"Bull. Soc. Fr.," February, 1905, p. 76.

Manganese-Ferricyanide Process.—According to a patent of the Neue Photographische Gesellschaft, Berlin, the following process serves for toning bromide and other silver prints:—It consists in treating the picture first with a solution of a manganic salt, a ferricyanide and an acid, and then with an alkaline solution of a ferricyanide, and afterwards colouring in any suitable manner the manganese picture thus produced. The following is a specimen of the way the process is carried out:—Solutions: A.—3 c. cs. of 10 per cent. potassium bromide solution, 2 c. cs. of 10 per cent. citric acid solution, 3 c. cs. of the manganic solution prescribed below. B.—20 c. cs. of 2 per cent. potassium ferricyanide solution, 80 c. cs. of water. The manganic solution to be added in solution A. is made from 150 gms. of sodium tartrate, 25 gms. of crystallised manganous sulphate, 100 c. cs. of normal caustic soda solution, 100 c. cs. of 4 per cent. potassium permanganate solution. Bromide prints are treated in a bath composed of equal parts of A. and B. until the silver has disappeared. They are washed for a short time and then brought into Bath II., whereupon they assume a brown colour. Bath II.—90 c. cs. of 2 per cent. potassium ferricyanide solution, 10 c. cs. of normal caustic soda solution. The manganese picture thus produced is now again washed, and may be coloured in the known manner by means of aniline hydrochloride, for instance.—Eng. Pat., No. 10,898, 1904.

The Instability of Uranium-Toned Prints.—M. Lemaire ascribes the instability of uranium-toned prints to the image being composed of a mixture of ferrocyanides of uranium and silver, and states that if the toned print was immersed for five minutes in a 0.2 per cent. solution of carbonate of soda, it showed no trace of the characteristic iridescence after six months' exposure to the air, and only faint traces after ten months. Comparative tests were made, and the author comes to the conclusion that the alteration of the prints is entirely due to the silver ferrocyanide, and that the treatment with sodium carbonate converts this into the more stable carbonate of silver, that this may be eliminated by subsequent treatment with a 5 per cent. solution of nitric acid, and that the prints are then stable.—"Bull Soc. Franc.," March, 1905, p. 84.

R. E. Blake Smith recommends as a bleaching solution for bromide prints, prior to re-development:—

Potassium ferricyanide	140 grs.
Potassium bromide	½ oz.
Water to	10 ozs.

This can be used repeatedly.

He also suggests a cupric-bromide bleacher as follows, for the purpose of obtaining a satisfactory method of silver intensification with negatives :—

Copper sulphate	½ oz.
Potassium bromide	½ ,,
Concentrated sulphuric acid	50 minims
Water to	10 ozs.

After bleaching wash in four changes of ½ per cent. nitric acid, then immerse in :—

Silver nitrate	90 grs.
Concentrated nitric acid	50 minims
Water to	10 ozs.

and a dark brown image is formed.

The plate is then washed for 20 minutes, and placed in :—

Metol	45 grs.
Sodium sulphite	130 ,,
,, carbonate	270 ,,
Water to	10 ozs.

In this the silver sub-bromide and silver bromide are reduced to metallic silver. The darker parts of the negative are much more intensified than the lighter, *i.e.*, contrasts are increased.

An improved method is as follows. A negative is bleached with :—

Copper sulphate	½ oz.
Potassium bromide	½ ,,
Sodium sulphite	9 grs.
Concentrated sulphuric acid	50 minims
Water to	10 ozs.

Then washed in four changes of :—

Sodium sulphite	9 grs.
Cncentrated sulphuric acid	25 minims
Water to	10 ozs.

Then rinsed for 3 minutes, and transferred to :—

Silver nitrate	90 grs.
Concentrated nitric acid	75 minims
Water to	10 ozs.

until darkening is complete.—"Phot.," August 29, 1905, p. 173.

Green Tones.—C. Winthrope Somerville advises the following method :—Soak the print in water till limp, then tone in :—

Vanadium chloride	2 grains
Ferric oxalate	1 grain
Ferric chloride	1 ,,
Potassium ferricyanide	2 grains
Saturated solution of oxalic acid	120 minims
Distilled water	4 ozs.

Make the vanadium chloride into a stock solution by putting

into a bottle and adding a hot 5 per cent. solution of hydrochloric acid. To make the above solution, add the vanadium to the oxalic acid, then the ferric oxalate, then the ferric chloride and some of the water, and add slowly, with constant stirring, the ferricyanide. The solution should be a light-green colour, and quite clear. Care must be taken to use exact proportions as given. The print turns slate-blue in this, and toning should be carried on till the lightest half-tones are tinted, though it may be stopped at any stage with, of course, variations of tint. Rinse the print in water, and immerse in water to which very little strong ammonia has been added, one or two drops to the pint of this gives the green colour. Then wash and dry.—" P.N.," May 19, 1905.

Vanadium in Bromide Toning.—W. E. Bradley describes the use of chloride of vanadium for bleaching bromide prints instead of ferricyanide of potash or other compounds. He recommends amidol as developer, ferrous oxalate being suitable for all tones but green. Prints must be very thoroughly washed, and are then bleached in :—

Saturated solution of vanadium chloride ...	2 drams
Potassium pyrophosphate	2 ,,
Ferricyanide of potassium	30 grains
Water	10 ozs.

The prints bleach in about 10 minutes, and can then be toned by re-development after 15 minutes' washing.

For blue tones re-develop in :—

Ferrous sulphate...	10 grains
10 °/o solution hydrochloric acid	2 drams
Water	10 ozs.

Toning takes about an hour. Prints are then washed and placed in weak hydrochloric acid bath, and again washed.

For bluish green tones re-develop in :—

10 % solution of ferric chloride	1 dram
10 % solution of hydrochloric acid	2 drams
Water	10 ozs.

Development takes 2 hours. Rinse in 7 or 8 changes of water. The print deteriorates with too much washing. Stains can be removed with cotton wool and 5 per cent. solution of potassium carbonate.

Pinkish brown tones are produced with :—

10 °/o solution of copper chloride	1 dram
10 °/o solution of hydrochloric acid	2 drams
Water	10 ozs.

Brilliant red brown tones are obtained with :—

Uranium nitrate	5 grains
10 °/o solution of hydrochloric acid	2 drams
Water	10 ozs.

The bleached prints should be developed in this in a bright light.

If the bleached prints are re-developed in a 5 per cent. solution of Schlippe's salt until a yellowish red image is formed, and transferred to a weak solution of ammonia for 10 minutes, then washed and further developed in the copper chloride solution given above, the image will assume a dark brown tint in about an hour.

Warmer tones are produced in the following :—

5 °/₀ solution of platinum chloride	1 dram
10 °/₀ solution of hydrochloric acid	2 drams
Water	10 ozs.

The yellowish red image changes in this, first to red, then to light brown, then to deep reddish brown. To stop toning before final colour is reached fix in hypo. A similar result is produced by using 2 drachms of a solution of chloroplatinite of potash 15 grs., water 1 oz.. in 10 ozs. of water.

For production of green tones bleach original print in :—

Potassium bisulphate	½ oz.
Pyrophosphate of potash	1 dram
Saturated solution of vanadium chloride ...	2 drams
Ferricyanide of potassium	10 grains
Water	10 ozs.

Reduction is slow, and leaves image of pale green colour. Print is well washed and immersed in :—

10 °/₀ solution of ferric chloride...	1 dram
10 °/₀ solution of hydrochloric acid	2 drams
Water	10 ozs.

and image turns bright green. Prolonged washing degrades the tones.

For lantern slides the Schlippe's salt toning method given above is recommended for clear, rich colours.—"A.P.," November 15, 1904, p. 391.

Developers for Toning Processes.—H. H. Wight, in a lecture before the Adelaide Camera Club, gives the results of his experiments in toning bromide paper and lantern slides. For the hypo-alum both prints and slides are best developed with amidol. Rodinal and edinol are good, but metol-hydroquinone unsatisfactory. For uranium, edinol, hydroquinone and ferrous oxalate are suitable, but amidol gives stained high lights. For copper toning, amidol is the best: hydroquinone-metol unsatisfactory. For platinum toning, amidol and edinol give best results.—"Aust. Phot. Rev.," June, 1905, p. 201.

W. E. Gates, in a paper read before the Photographic Society of New South Wales, describes the influence of various developers in determining the colour of toned bromide prints.

The developing agents employed were amidol, metol, metol-hydroquinone, ortol, hydroquinone, rodinal, ferrous oxalate, and pyro-acetone. The toning processes were hypo-alum and copper bromide with sodium sulphide. The results obtained by each

toning agent were very similar with a given developer. Amidol gave the coldest, and hydroquinone the warmest, tones, the range of colour progressing thus: Amidol, metol-hydroquinone, quinone.—"Aust. Phot. Rev.," February, 1905, p. 44.

The Carbon Process.

The Action of Bichromates on Gelatine.—Since the classic researches of Eder on the action of the chromates on colloid matters in the presence of light, practically no work has been done on this subject, but the subject has recently been taken up by MM. Lumière and Seyewetz. In a paper by them, read at the International Congress of Photography, held at Liège from July 19 to 24, the conclusions come to are as follows:—1. Bichromated gelatine rendered insoluble by the action of light contains chromium sesquioxide (Cr_2O_3) and caustic potash, and that the latter forms, with the excess of bichromate, the less sensitive neutral chromate. 2. This gelatine differs considerably in its composition from that which is tanned by the chromium oxide salts. The oxide of chromium, which it contains, appears to consist of two portions—the one portion is constant, and corresponds to 3.5 per cent. of the chromated gelatine. It is comparable with the oxide, which the gelatine, rendered insoluble by the chromium oxide salts, retains. The other portion varies with the duration of the exposure, and is produced by the reduction of the bichromate by the organic substance in light. 3. The quantity of the chromium oxide, which is retained by the insoluble gelatine, increases with the duration of exposure, but not in proportion. This increase becomes weaker and weaker in proportion as the quantity of the neutral chromate increases. 4. The decomposition of the excess of bichromate by the chromium sesquioxide appears to be only partial, as stated by Eder. On account of the instability of this substance, an analysis can give no accurate conclusion as to its composition.—"Phot. Woch.," September 5, 12, and 19, 1905, pp. 349, 359, and 369.

Carbon Tissue with Soluble Substratum.—Albert Hochheimer, of Munich, patents the use of paper or celluloid tissue provided with a coating of gum arabic or other substance, soluble in cold or warm water, underneath the layer of pigmented gelatine. The substances of the substratum, when bichromated, are less sensitive to light than the pigmented layer. In the case of pigment paper or tissue thus prepared, the original paper base, after the copy has been transferred in the well-known manner in cold water on to the developing paper, can be easily removed in the air, that is, when taken out of the water, without or with the help of warm water. As a further advantage of this pigment paper, it may be mentioned that it can be employed without the safety edge on the negative which has hitherto been necessary.—Eng. Pat., No. 23,766, 1904; Ger. Pat., No. 158,234, 1904.

Dr. Ludwig Strasser exposes paper coated with a sensitive salt of iron, mixed with gelatine, under a negative (a visible image

being obtained), and then applies a paper bearing a film of unexposed pigmented and bichromated gelatine. The gelatine of this latter becomes insoluble on contact with the light-affected iron salt. The two papers, adhering to each other, are placed in hot water and the pigment paper developed, as in the single transfer process, the primary paper bearing a film of hardened gelatine for this purpose. The two papers can be separated after short contact, the whole of the pigmented gelatine adhering to the primary paper and containing reduction products of the bichromate. It is then brought into contact with ordinary transfer paper, and developed. The following are examples of the above way of carrying out the process:—Smooth paper is treated with a solution of—

Gelatine	1 gramme
Alum	0.1 ,,
Citrate of iron and ammonium	2 grammes
Water	20 c. cs.

After drying, the paper is exposed to light until the details are just visible in the light parts of the copy. Then the pigment-paper is impregnated with a 5 per cent. solution of bichromate of potassium, the excess of the solution is removed, and the paper is immediately pressed, without being wetted, upon the above copy, so as to avoid air-bubbles. After drying, the development is effected in the usual manner, whereby the picture adheres to the originally sensitised paper. 2. Smooth paper is covered with a solution of—

Dextrine	10 grammes
Citrate of iron and ammonium	10 ,,
Water	100 c. cs.

After drying, the paper is exposed to light, as indicated in example 1, and then pressed upon the chromated pigment-paper. After about one minute, the two papers are separated from each other, the pigment-paper is quickly rinsed with cold water and then pressed upon dry ordinary transfer-paper, or any other correspondingly prepared substratum, thereby avoiding air-bubbles. After completely drying, the development is effected in the usual manner.—Eng. Pat., No. 17,192, 1904; "B.J.," June 30, 1905, p. 515.

Preparing Carbon Tissue.—This may be prepared from the following:—

Water	2,400 c. cs.
Gelatine	330 grammes
Soap	75 ,,
White sugar	105 ,,
Dry colour	5 ,,

Dissolve the soap and sugar in the water, and soak the gelatine in the same till soft then melt by the aid of a water bath. Rub the finely-powdered dry colour up in a mortar with a little of warm gelatine solution, gradually add the rest of the solution, and filter. Lay a sheet of damp paper on a level slab, turn up the edges, and pour in enough of the warm gelatine to give when dry a film of the thickness of an ordinary visiting card. The colours may be Indian ink, carmine lake, Indian red, or any other stable mineral colour.—" Phot. Korr.," April, 1905, p. 191, from "Prager Tagblatt."

Carbon Prints from Flat Negatives.—The following process is recommended by a writer in the "Prager Tagblatt" for obtaining deep black tones from flat negatives:—When the print has been thoroughly freed from bichromate, it is immersed in a 1 per cent. solution of ferric chloride, till the film is saturated, then briefly washed and immersed in a 0.5 per cent. solution of gallic acid, till sufficient intensity is obtained. If a ferrous salt is used in place of the ferric, and tannin or campechy wood used instead of the gallic acid, any tones from blueish red to blue-black can be obtained. In order to obtain greenish blue tones, ferrous sulphate, followed by potassium ferrocyanide, should be used. These processes are not new, and there is considerable chance of obtaining stained papers by this method.—" Phot. Korr.," April, 1905, p. 192.

Halation in Carbon Printing.—Hans Schmidt recommends placing a sheet of opaque paper behind a pigment film (in the printing frame) if the pigment is at all transparent. The evil action of reflected light is thus prevented. An experiment showing that such action takes place is as follows:—Print from a negative of some dark subject on to pigment film of fair transparency, interposing a sheet of an old letter or a page of printed matter between the tissue and the back of the frame. On development, the characters will be visible in the print.—" Phot. Mitt.," II December, 1904, p. 379.

Carbon Transparencies and Reticulation.—A substratum of insoluble gelatine is the chief factor in avoiding this defect. A weak gelatine solution—1 oz. per pint—with enough bichromate to give it a sherry colour, makes a good substratum, and only needs warming to be ready for pouring on. After exposure the tissue is coated with collodion, and then developed in the usual way. The hottest water can be used without fear of reticulation. —"B.J.," November 11, p. 964.

Tinting Carbon Prints.—A method of colouring carbon prints is given by G. Cadogan Rothery. A bath containing 200 c. cs. of water, 60 gms. of gelatine, 10 of sugar, and 10 of white soap, is prepared. When these ingredients have been thoroughly amalgamated on a water bath, add the dye or pigment, and paint the composition over the paper. This is then sensitised with bichromate, and dried in the dark as usual. It is clear that only such colouring matters can be used as are unaffected

both by gelatine and by bichromate. The following give good results:—

Purple black	Indian ink	5 parts by weight
	Indian red	5 ,, ,,
	Burnt umber	5 ,, ,,
Deep black	Indian ink	20 ,, ,,
	Indigo	2 ,, ,,
	Carmine lake ...	1 ,, ,,
Violet	Indian ink	3 ,, ,,
	Indigo	4 ,, ,,
	Carmine lake... ...	5 ,, ,,
Dark blue	Indian lake	2 ,, ,,
	Indigo	8 ,, ,,
Red	Indian ink	5 ,, ,,
	Indian red	5 ,, ,,
	Carmine lake... ...	5 ,, ,,

Aniline dyes are also largely used, but most lakes are inadmissible, as they render the gelatine insoluble before exposure. Bone-black may be substituted for Indian ink, and sepia, gamboge, Prussian blue, and sienna, raw or burnt, are all of excellent service. The dyeing and sensitising of the paper may be combined in one operation. Make the dye or pigment into a paste with a little water, and mix the paste very thoroughly with a mixture of equal parts of thick gum arabic and saturated solution of ammonium bichromate. Paint and dry the paper in the dark. For carbon positives on glass, mix the dye with the following liquid:—

Water	1000 grammes
Gelatine	150 ,,
Glycerine	6 ,,

and then mix with ammonia bichromate and sensitise the paper.

Uranium may be used with carbon positives. The gelatinised plate is alumed, rinsed, and dipped into a 20 per cent. solution of uranium nitrate, drained, dried, and exposed in a printing frame under the negative as usual. The print is shaded or coloured in one of the following baths:—

Blood red	2% solution of potassium ferricyanide.
Violet	½ % solution of gold chloride.
Black	Same bath, followed by a dipping into an acid 5 % solution of ferric chloride.
Blue	Wash the black prepared as above with water ontaining 1 % sulphuric acid.

Gum-Bichromate.

Making Gum Paper.—J. Page Croft recommended before Derby Photographic Society, that the paper be first coated with gum solution (1 oz. to 3 ozs. of water), and sensitised afterwards. The following are the amounts of colour he used to the drachm

of 10 per cent. bichromate solution :—For a dead black : lamp-black, 1 gr. For a warm black : vegetable black, $1\frac{1}{2}$ gr. For browns : brown colour, 2 to 3 grs. For reds : red colour, 4 to 5 grs.

The ground colour was incorporated with the bichromate solution in a mortar, laid on with a hog's-hair brush, and afterwards smoothed down with a badger softener. After soaking for five minutes in cold water, the prints developed in warm water. Hollingworth's Turkey mill or Whatman's hot-pressed paper was recommended.—"Phot.," January 31, 1905, p. 174.

Starnes' Gum Resin Process.—Herbert W. Starnes communicated to the London and Provincial Photographic Association a bichromate-pigment process with the advantage that the grain of the image can be modified by pressure of absorbent materials of various textures upon the print. The vehicle of the pigment is a mixture of two gum resins—one extremely soluble, the other relatively insoluble, but a tacky adhesive. The sensitising mixture consists of these two, with pigment and bichromate. The paper is dried, and exposed under a negative. To develop, the print is soaked in cold water for two or three minutes, the water softening the soluble gum where the light has not acted and loosening the pigment. Then by pressing a dry absorbent material such as blotting-paper on the surface of the film, the pressure causes the adhesive resin and the loosened pigment to clog together and adhere to the face of the blotting-paper. This is instantly pulled away, leaving the insoluble image pressed down on the surface of the paper. The print then has a solution of alum poured over it to clear off bichromate and harden the image, and is then rinsed in water and dried.—"B.J.," January 6, 1905, p. 11.

Print-Out Gum.—E. J. Wall suggests that Dr. Reiss' silver-gum process (see "Various Print-Out Processes") might be applied to the preparation of a print-out gum-pigment paper.

It is an old idea to immerse gelatino-chloride paper in bichromate and then print, but this gives us far too heavy a coating of gelatine. It might be possible to print out Dr. Reiss's gum emulsion, then soak in bichromate solution, and then develop with warm water, for Howard Farmer has proved that a metallic silver image in the presence of bichromate will render gelatine insoluble, and what is applicable to gelatine is in all probability applicable to another colloid like gum arabic. By applying this principle we could obtain an image in finely divided silver, suspended in gum or other colloid, and insoluble within a certain time in cold water.

Dr. Reiss has also used nothing but silver nitrate. There is no reason why a chloride should not be incorporated with his emulsion, and as regards the keeping properties of it, it is generally known that the addition of citric acid or other organic acid will preserve a printing-out emulsion for some time. In fact, it is not necessary to have an acid emulsion, or one with an excess of silver nitrate, to obtain excellent results. —"B.J.," December 16, 1904, p. 1063.

"Pract. Phot.," No. 18, February, 1905, is devoted to gum bichromate.

Carl Pflanz has patented a pigment-bichromate process in which the paper is first coated with a soluble colour and then with a layer of bichromated, or unbichromated, albumen. It is claimed that the layer of colour will not become dissolved with the layer which is used as a carrier for the sensitising medium when it is quickly applied. Also, that the time of exposure need not be altered in accordance with the different colours of the pigment paper, as the light always passes through a uniform uncoloured upper sensitive layer. Properly sized paper is coated with a soluble layer of colouring matter and dried. Then a solution of bichromated albumen (say 50 parts by weight of albumen, dissolved in 100 parts by weight of bichromate of potash 1 :10) is applied, or, instead of this solution, bichromated dextrine (1 :2), may be used, and the whole left to dry again. The paper is now ready for use, and the printing is accomplished with the aid of a photometer, whereupon it is soaked in cold water and developed, say, with a brush.—Eng. Pat., No. 11,077, 1905.—"B.J.," September 22, 1905, p. 756.

Pigments for Gum-Bichromate.—Klosel specially recommends the following mixtures of tempera colours for gum printing :—

Warm brown—

Bone black	...	5 parts
Vandyke brown	...	3 ,,
Ivory black	...	2 ,,
Indian red...	...	1 ,,

Purple brown—

Ivory black	...	5 parts
Vandyke brown	...	4 ,,
Dark alizarine lake		2 ,,
Indian red...	...	1 ,,

Yellowish brown—

Ivory black	...	5 parts
Bone black	...	5 ,,
Burnt Sienna	...	1 ,,

Dark brown—
Bone or ivory black alone

Brown (for sunset effects)—
Bistre

Browns (various medium shades)—

Bone black...	...	5 parts
Vandyke brown	...	4 ,,
Burnt Sienna	...	1 ,,
Indian red...	...	1 ,,

For bright tones—

Bone black...	...	5 parts
Vandyke brown	...	4 ,,
Sienna ...	...	4 ,,

For deep tones—

Ivory black	...	5 parts
Vandyke brown	...	3 ,,
Indian red...	...	1 ,,

Blue—

Ivory or peach black		5 parts
Indigo ...	...	5 ,,
Paris blue ...	...	1 ,,

Dark green—

Bone black...	...	5 parts
Paris blue ...	...	2 ,,

Or—

Bone black...	...	5 parts
Indigo ...	...	5 ,,
Blue black...	...	5 ,,
Paris blue ...	...	1 ,,
Cadmium ...	...	1 ,,

Bright green—

Vandyke brown	...	3 parts
Paris blue ...	...	1 ,,

Olive green—

Sienna	... ...	2 parts
Indigo	... ...	2 ,,
Bone black...	...	5 ,,

Red—

Ivory black	...	5 parts
Burnt Sienna	...	2 ,,
Indian red ...	...	2 ,,

Warm red—

Bone black	...	5 parts
Red chalk ...	...	3 ,,
Indan red ...	...	1 ,,

Dark red—

Peach black	...	2 parts
Alizarine lake	...	1 ,,
Indian red...	...	1 ,,

Black (for pencil drawings)—
Graphite

Black—
Peach or blue black

Warm black—
Ivory black

—"Phot. Mitt.," II. May, 1905, p. 155.

The Bayer Company, of Germany, have patented a process, the basis of which is the fact that neutral and insoluble chromates, *e.g.*, those of copper, cobalt, mercury, etc., in presence of a dilute acid, insolubilise a layer of colloid and pigment. Paper is sensitised with a ferric salt, such as does not form (when reduced) a preciptate with bichromate, but does so with neutral chromates. A visible image of ferrous salt is obtained, and, on treatment with a bichromate, reduces the latter to chromate, the latter at once yielding a precipitate with a metallic salt, such as sulphate of copper, present in the paper. The precipitate thus forms on the parts acted upon by light, and the paper is then washed for a short time and presed against a pigment paper impregnated with a dilute acid. After some hours development is done in hot water in the usual way, with the result of an unreversed pigment print. Suggested formulæ for the process are :—Coating mixture : Water, 1,000 parts; gelatine, 10 parts; chrome alum, 5 parts; ferric chloride, 100 parts; citric acid, 100 parts; and copper chloride, 100 parts; dry in the dark. To prepare a copy expose in daylight under a negative until the picture is clearly visible. Immerse the copy for 1 to 2 minutes in a solution containing 5 per cent. of bichromate of potassium, wash 5 minutes under the tap, to remove the excess of bichromate, and then press the copy under dilute sulphuric acid (5 :10000) against a pigment paper (coated with gelatine or gum and a dye). Squeeze the two papers together to remove the air bubbles, and press between blotting-paper for about 3 to 6 hours. Then soak in hot water, until the picture can be readily detached from the pigment paper, and wash the former with hot water until all the parts not acted upon by light have disappeared and a very distinct picture is visible.—Eng. Pat., No. 26,456, 1904.

MULTIPLE GUM.

C. Puyo gives examples of how double or triple printing can

modify tone. Thus in a landscape negative with clouds the alternatives of too heavy foreground with fully-printed sky, or proper foreground but clouds missing, are avoided by printing the sky first on a thin coat, and, after development, printing the foreground. Also if the distant planes of a subject are over-sharp, these parts are printed on one coat first through a sheet of celluloid or gelatine, and the foreground obtained on a second sensitising. Also a hard portrait negative is first distinctly under-exposed on a thin coat, and a second impression (over-exposed and vigorous) done on this first flat print. On the other hand, from a flat negative a print is taken, the parts in which are desired raised in tone are not touched, and the rest is cleaned off with the brush. A second printing gives the lacking contrast.

Double Tone Effects.—Puyo dwells on the advantage of two printings in colours which are fairly close to each other, such as black on deep brown (bistre), brown on dark red, and so on, the print in each colour being locally developed with a brush. The finished print, viewed at a short distance, should not appear multi-coloured. If it lack harmony, a third printing, in a colour intermediate between the two, may be needed.

Multi-Colour Effects.—As example of his procedure, M. Puyo describes the making of his "colour-gum," No. 66, in "The Photographic Salon," 1904 ("Profil en Quatre Couleurs"). The first print is in Venetian red and brown red first developed as a whole, after which the hair was lowered with a brush with all the rest of the subject except the figure. The second printing was done in neutral brown (raw sienna, burnt sienna, burnt umber, red pointe, and black pointe, and was for the hair, other parts being wholly or partially removed. The third printing was in cadmium and chrome yellows, and was left only in the background. Payne's cobalt grey and pointe de carmine formed the fourth print, which was left in the face, the hat, and fichu: being partly removed from the hair and background. Thus the skin consists of sanguine and blue; the hair of sanguine (partly removed), bistre, and traces of blue; the hat and fichu, of dark brown (partly brushed away) and blue; the background of yellow, brown, and blue (partly removed).—"Rev. Suisse," November, 1904, p. 465.

Various Pigment Processes.

OIL PRINTING.—AUTO-PASTEL.

Oil Printing.—G. E. H. Rawlins advocates the old Poitevin process of 1855 (Eng. Pat., No. 2,815), as giving the pictorial worker all the control of gum. Good quality cartridge paper is coated with a solution of plain gelatine, to which a hardening agent, such as formaline or chrome alum, is added. It is dried,

and sensitised as required on 2½ per cent. solution of potass bichromate, as in the carbon process. After exposure behind the negative, it is transferred to water, when the lights swell up and remain absorbent, whilst the shadows retain but little water. When drained and surface dry, the print is laid face upwards on a glass plate, and rolled with printer's ink, thinned to a cream with turps. The ink clings to the shadows, but is rejected by the lights, and there results a positive in oil-pigment. —"B.J.," November 11, p. 977.

Mr. Rawlins gives further instructions as follows:—Special tissue and pigments are made by Elliott & Sons, Limited. The former prints in about half the time of P.O.P., and after washing in tepid water, is pigmented. A little pigment is mixed with a little turpentine, taken up on a roller squeegee, and applied therewith to the print, laid (wet) face up on a sheet of glass and freed from surplus water by blotting or dabbing. The colour at first adheres all over, but as the turpentine evaporates the high lights give up the pigment, and the whole picture gradually appears. "Mealiness" is remedied by continued rolling up. To "fake" the print, a stumpy stencil brush is dropped repeatedly, without pressure, on the print, holding it vertically over the spot whence the pigment is to be removed. Thin oil pigments give flatness; thick, sticky oils, contrast. Turpentine is used as a temporary diluent of the pigment to facilitate its distribution; it should not get into the brushes, or it will thin the pigment and spoil the result. To thin the pigment permanently, add a very little linseed oil or ordinary tube oil-paint.—"Pgm.," March, 1905, p. 83.

Mr. Rawlins' original and lengthy description of the oil process appeared in the "A.P.," for October 18, 1904, and later issues of the same journal refer further to the process:— "A Criticism on Oil Printing," by Chapman Jones, and a rejoinder by G. E. H. Rawlins, November 29; "Hopes and Fears for Oil Printing," by F. C. Tilney, December 6, 1904; and "Notes on the Practice of Oil Printing," by Thomas Bolas, December 20, 1904.

Auto-Pastel Paper.—G. A. Towers gives a *resumé* of this process, which is briefly:—(1) Sensitise the prepared paper in 5 per cent. solution of bichromate of potash. (2) Dry in a warm dark room. (3) Print under negative for possibly slightly longer than for carbon paper. (4) Soak in cold water, with two or three changes, for three or four minutes, then transfer to hot water 120 to 150 degrees F. (5) Brush, while in the hot water, with a broad camel-hair brush, which reveals the image, when general or local development is continued until print is light enough, or until desired modifications are obtained. (6) Wash for a few minutes, and dry.

The negatives for auto-pastel should be as strong as for printing with carbon. Drying the paper after sensitising requires much care. It should be carefully blotted on leaving the bichromate bath, and then hung up to dry.—"A.P.," February 14, 1905, p. 129.

Platinum Printing.

Warm Tones.—W. H. Smith gives the following table as a guide in obtaining warm tones on platinotype papers:—

Paper.	Developer.	Temperature Deg. Fahr.	Colour.
Cold bath	D salts	60	Cold black
"	"	140	Warm "
"	*Old* Sepia	170	Brown "
Sepia	Sepia	60	Cold Sepia
"	"	170	Warm "

For very flat negatives, or when using stale paper, the addition of 1 gr. (in no case to exceed 2 grs.) of bichromate of potash to every 20 ozs. of developer, gave noticeably increased contrasts. This property gradually wore off in the developer, and might be compensated by the very cautious addition of fresh bichromate. —"B.J.," March 3, 1905, p. 167.

Harsh Prints on Platinotype.—Ward Muir gives a method of securing bright, plucky platinotype prints from flat, weak negatives. Print much deeper than is ordinarily required, and develop in a weak developer composed of an ounce of the usual oxalate of potash developer diluted in about 4 ozs. of water. The exact amount of dilution will be ascertained by trial. In this developer the lighter details of the over-exposed print will float off, and the shadows will remain. If a slightly brown toned print is required, a drop or two of mercury perchloride solution will give the desired effect.—"A.P.," May 16, 1905, p. 600.

Reducing Sepia Platinotypes.—Sepia platinotypes can be reduced, or markings caused by dampness, can be removed, by treating the prints with:—

Potassium iodide	120 grains
Distilled water...	10 ounces

Dissolve and add—

Iodine	60 grains

To this is added a solution of ½ oz. of cyanide potassium in 10 ozs. of water.

This reducing solution is also useful to improve the whites of a black platinotype print. The print must be well washed after reduction.—"Wilson's," January, 1905, pp. 3 to 7.

Platinum Printers' Catarrh.—Several correspondents of the "British Journal of Photography" complain that a kind of catarrh, with sneezing, running from the nose, etc., has followed the constant use of platinum paper. It is pointed out in an editorial note that in a few isolated cases, a species of catarrh,

with symptoms somewhat akin to hay fever, has inflicted itself on platinotype printers. The direct cause of this is the dust, or small particles of chemicals, which may arise from the paper, acting on a hypersensitive temperament, possibly equally sensitive to other forms of dust. When such a peculiarity asserts itself, careful attention should be paid to ventilation, and the paper should be purchased in cut sizes, so as to avoid cutting it up, and consequent disengagement of small particles. For this and other reasons, tearing the paper should be carefully avoided. Oxalate powder, if inhaled through the nose, will give effects similar to those complained of. This might occur when making up solutions.—"B.J.," May 26, June 2, 9, 16, 23, 1905.

E. J. Wall contributes a historical review of the platinotype process, full instructions for the making of the various papers, and a bibliography of the process, to the "Year-Book of Photography," 1905, pp. 197 to 226.

Exposure in Platinum Printing.—A. J. Jarman compares the value of electric light *v.* daylight for platinum printing. He makes tests to ascertain the effect of different coloured media interposed between the light of the arc lamp and the negative. When tissue paper of pale orange, yellow, and red were used, although the shadows were better rendered, the exposure proved too long.

Pale yellowish green gave fine results, rivalling daylight prints. With white tissue paper the daylight print proved better than that by arc light. With bright medium blue the results were superior to those produced under white tissue paper. Coloured glasses or gelatine were recommended.—"Wilson's," March, 1905, p. 103-104.

J. McIntosh deals, in a series of articles, with methods of modifying platinum prints, by alterations in the developer, by after treatment, by intensification, and by reduction. Various tested formulæ are given, and tables for altering the proportions of the constituents of the developer to obtain warm colours. He obtains lavender tones on some brands of paper by developing with :—

Potassium oxalate	1 oz.
Potassium phosphate	1 ,,
Citric acid	10 grs.
Water to make	10 ozs.

Intensification of the image is effected by immersion in :—

Water	2 ozs.
Acetic acid	40 minims
Ferrous sulphate	10 grains

To this 4 or 5 drops of a 60 grain solution of silver nitrate are added just before use. After the required amount of intensification has taken plate the print is rinsed in two or three changes of dilute acetic acid and well washed. After washing, it is fixed in hypo and again washed and dried.—"Phot.," May 30, June 6, July 4, 1905.

Iron Printing Process.

(Other than Platinum, Blue Print, etc.)

Dr. Lux contributes some useful, but not particularly novel notes on heliographic processes, and points out that a hard, well-sized raw paper is required, and that to use a shop phrase, it should be "not full a little more than three-quarter sized." Caseine and albumen sizes are unsuitable, as they render the washing out of the iron salts difficult; for the same reason, gelatine and other colloids should be avoided; resin size is to be preferred. The paper should be tested by coating a small piece, exposing to light, and washing, and also washing without exposure; these tests show whether the paper is even in structure. For the ferroprussiate process, 500 to 600 sq. m. of paper surface should be coated with 1000 gms. of ammonio-citrate of iron, and the green variety is the best. For very hard pure wood-pulp paper the following is recommended :—

Ammonio-citrate of iron	1000 grammes
Water	2000 c. cs.
Potassium ferricyanide	333 grammes
Water	1000 c. cs.
Dextrine	30 grammes
Water	500 c. cs.
Potassium bichromate (10 % solution)...	10 ,,

For a very soft paper with plenty of cotton :—

Ammonio citrate of iron	1000 grammes
Water	2000 c. cs.
Potassium ferricyanide	333 grammes
Water	1000 c. cs.
Water	5000 ,,

The above solutions when mixed will give a paper that will keep for a month; greater sensitiveness, but at the cost of keeping power, is obtained by adding :—

Oxalic acid	10 grammes
Water...	100 c. cs.

The paper after coating should be dried within $2\frac{1}{2}$ to 3 minutes For the ferrogallic process the following is used :—

Soft collotype gelatine	450 grammes
Water at 105° Fahr.	1000 c. cs.

Dissolve and add—

Tartaric acid	175 grammes

Filter and add—

Ferric chloride	800 grammes
Water to	2000 c. cs.
Ferric sulphate	200 grammes

Stir till a clear solution is obtained, and allow to stand several days till the mixture becomes fluid; it is then ready for coating.—"Phot. Indus.," February 8, 1905, p. 117.

Practical instructions for making ferro-prussiate, kallitype, and other iron papers, are given, by Basil Lefarge, in the "Year-Book of Photography," 1905, pp. 227 to 262.

COPYING TRACINGS.

For copying large tracings the Elswick Works of Sir W. G. Armstrong, Newcastle-on-Tyne, use a cylinder of glass segments, which is slowly revolved in a horizontal direction, whilst a web of the sensitive material is fed on to it, at the same time, the tracing to be copied is fed in in contact. Arc lamps fully expose the paper by the time it passes by, and in this way cyanotype prints can be made at the rate of 200 ft. per hour, ferro-prussiate at 100 ft. per hour, and ferro-gallic at 60 ft. per hour.—"Process Year-Book," 1904-5,; "B.J.," January 13, 1905, p. 23.

H. R. Watts patents a machine for copying long tracings, in which a series of rubber rollers press against a flat glass plate, between which and the rollers the tracing and paper are fed.—"Eng. Pat.," No. 3,382, 1904; "B.J.," January 13, 1904, p. 36.

Miscellaneous Processes and Prints on Various Supports.

Making Metallotype Paper.—H. Quentin chooses either a metal-coated paper or a pure Rives raw paper. If the latter, it is first wetted and a weak solution of gelatine applied. Before this has dried aluminium or bronze powder is dusted over, the paper left to dry, and then passed through a burnishing press. It is best, however, to choose a stout "gold" or "silver" paper, the first treatment of which is the application of an insulating film. Enamel collodion (2 gms. of castor oil per 1000 c. cs. of 2 per cent. collodion) can be used, but better a varnish of : transparent white celluloid, 15 gms.; amyl acetate, 250 c. cs. The celluloid swells up and soon dissolves to a thick solution, which is easily spread with a brush and dries rapidly. The varnish should be used in a well ventilated place as its fumes are very inflammable. The coated paper is hung up for several days to dissipate the last traces of acetate.

Emulsion :—A. Silver nitrate, 8 gms.; citric acid, 2 gms.; warm water, 40 c. cs. B. Gelatine, 24 gms.; ammonium chloride, .7 gm.; water, 175 c. cs. C. Tartaric acid, .7 gm.; sodium bicarbonate, .35 gm.; alum, .45 gm.; water, 35 c. cs.

In coating, a printing frame is taken, the glass front removed, and the sheet of paper laid in the opening so that the sides exactly fall into the rebate occupied by the glass and the ends project about an inch at each end. The glass is re-inserted and holds the paper flat; the frame is levelled and the emulsion poured on. The paper is treated like any other P.O.P. If need be, greater contrasts can be got by adding .1 to .5 per cent. of bichromate of calcium in 10 per cent. solution to the emulsion.—"Phot. Rev.," December 18, 1904, p. 194.

PRINTS ON FABRIC, PORCELAIN, ETC.

Ferro-prussiate for Fabrics.—M. Depradels gives the following method of sensitising linen or other fabric: it should be first immersed in a warm 1 per cent. solution of gelatine and dried. The following solutions should be prepared:—

A.	Citric or tartaric acid	26 grammes
	Water	100 c. cs.
B.	Perchloride of iron	20 grammes
	Water	100 c. cs.
C.	Potassium ferricyanide	22 grammes
	Water	100 c. cs.
D.	Ammonia	40 ,,

A. and B. should be mixed together, and D. added, with constant stirring, a little at a time, and then C added. The mixture is to be applied with a brush or sponge. [This seems a somewhat clumsy way of preparing ammonio-citrate of iron, and better results would be obtained by using the commercial green ammonio-citrate.—Ed., B.J.A.]—"Phot. Rev.," March 5, 1905, p. 75.

Silver Prints upon Porcelain or Opal Glass.—A. J. Jarman describes at length his method of transferring print made on collodion paper to porcelain and opal surfaces. The surface is cleaned with strong carbonate of soda solution, soaked in muriatic acid 2 ozs., water 40 ozs., and well washed.

A substratum of—

Hard gelatine (Heinrich)	200 grains
Filtered water...	12 ounces
Granulated sugar	50 grains

melted and filtered, is poured over the surface, which is then drained and dried. The prints are prepared and toned in the usual way, but after fixing they are soaked in a bath of common salt 2 ozs., water 20 ozs., to prevent blistering. The prints are now pasted on to card mounts, and when quite dry are coated with the following mixture:—Albaline and thinner, equal parts, also known as amyl-acetate collodion and crystalline. The "thinner" is a special preparation for making a more limpid material of the amyl-acetate collodion. The varnished print is allowed to dry, and is then placed in a tray of hot water, and in a few minutes the collodion film containing the film will float off the paper support. The film is placed in clean, warm water, and can be at once placed in contact with the surface prepared to receive it, which should also be placed in the water. A camel-hair brush assists the placing and smoothing of the film into position. When dry, the surface can be varnished with the amyl-acetate collodion. Excellent transparencies may be prepared in this manner, and the application of the method to chrystoleum painting is obvious.—"Cam. and Dk. Room," May, 1905, pp. 140-4.

P.O.P. on Metal Surface Papers.—Quentin states that if the ordinary commercial gold and silver papers are coated with celluloid varnish, they may be coated with ordinary P.O.P. emulsion, without any deleterious effect on the emulsion.—"Phot. Mitt.," 1905, p. 45.

PRINTS IN RELIEF.

W. Perry Barringer describes the making of photographs in relief. For portraits it is necessary to whiten the hair, eyebrows, and beard of the sitter by dusting on powder. Pose in profile in a strong light against a black ground, slightly under-expose, and develop fairly hard. Place a piece of glass, well cleaned and warmed, in the bottom of a plate box, and pour on a warm gelatine solution to a depth of $\frac{1}{4}$ inch (1 oz. Nelson's gelatine soaked in cold water to 2 ozs. boiling water).

Let this set level, and when firm run a knife round edge and lift out plate and gelatine. When quite dry, soak plate in :—

Potassium bichromate	1 ounce
Strong ammonia	2 minims
Water	4 ounces

for 3 minutes, and dry in dark. The dry negative is placed in contact with this plate, and the image printed through a mask of black paper.

Exposure is made to bright sunshine for 15 minutes, and the plate is then put in running water in the dark for several hours, until the bichromate is quite eliminated. The image which is now in strong relief, is immersed in :—

Glycerine	$\frac{1}{2}$ ounce
Water	3 ounces

and a plaster cast is made from it. The plaster is mixed with water to form a liquid paste, and is poured on the relief in another plate box. When the plaster is bone dry, the sides of the box are broken away and the cast detached from the relief. The final impression can be of any metal, but lead is recommended as easiest to work.—"Focus," March 15, 1905, p. 257-8.

Decorative Reliefs.—R. Namias confirms his previous statement that the best mixture for high relief is gum and gelatine, the former never to be more than half the latter. The negative should have its densities proportional to the relief, not to the tone or colour of the original, and to this end the process of Baese is considered promising.—"Bull. Soc. Fr. Phot.," December 15, 1904, p. 577.

Relief Photographs.—F. Gartner prints on to sensitised unsized porous paper, stretches the latter on a frame, coats the back with glue, and applies a thin layer of plastic material (to subsequently set hard), and models it from the front with modelling sticks. Putty is mentioned as the plastic matter, and it is also claimed to use wax instead, and, after modelling, to remove the wax and fill the back of the picture with suitable hardening substance.—"Eng. Pat."; "B.J.," January, 20, 1905, p. 50.

Mounting and Mountants.

Mounting Flat.—Mr. Baird, in a lecture before the Dundee Photographic Association, showed how to mount dry prints on tinted papers so as to remain perfectly flat. The mounting is done with Higgins' mountant dabbed on very scantily with a

stubby mounting brush, without any added moisture. The print is rubbed down into position, and the *back* of the mount is then rubbed lightly with a damp sponge. It is then placed between clean sheets of blotting-paper and screwed up in a copying press for a night. It emerges perfectly flat and free from cockling, and remains so. It is preferable to mount each separate paper with large margins, and then trim down to size rather than trim before mounting.—"P.N.," April 7, 1905.

Dry Mounting.—M. Briand suggests the following method for dry-mounting prints :—

Shellac white or pale pallow	300 grammes
Gum elemi	30 ,,
Canada balsam	50 ,,
Methylated spirit 94°	1000 c. cs.

Divide the alcohol into three parts, and mix with each of the other ingredients; when they are all dissolved, mix. This should be painted on tissue paper, and allowed to dry for five minutes, and then the other side painted, and dried; paper thus prepared is placed between print and mount, and a hot iron passed over the print will cause it to adhere well.—"Phot. Gaz.," March 25, 1905, p. 99.

Starch Paste.—J. I. Pigg describes, with photo-micrographs, the eels of starch paste, and points out that they are the cause of starch paste "going bad," that they are extremely tenacious of life, and develop acid in the paste.—"B.J.," April 21, 1905, p. 304.

Enlarging.

Automatic Enlarging.—Henry Rex Cook patents mechanism for enlarging apparatus such that the parts can be automatically adjusted for given degrees of enlargement, and for the use of lenses of different focal length on a given apparatus.—Eng. Pat. No. 12,734, 1904; "B.J.," May 12, 1905, p. 370.

Exposing Enlargements by Rule.—N. C. Deck, adopts the following method for the estimation of exposure in enlarging :—

1. Place the negative in the enlarging apparatus and focus to the desired size, moving lens and easel as usual.

2. Measure the distance from the surface of the easel to the lens diaphragm with a tape in inches.

3. Divide the speed number of the paper to be used (given in table below), by the estimated density of the negative. Call this A. Opposite this A number in the following table find the corresponding *f* number :—

A Nos.	*f* Nos.
100	*f*64
50	*f*45
25	*f*32
12	*f*22
6	*f*16
3	*f*11
$1\frac{1}{2}$	*f*8
$\frac{3}{4}$	*f*5.6

4. Suppose the A. number is 50, then the *f* number is *f*45. Now if we used an aperture on the lens *which had this value*, the correct exposure would be identical with the actinometer time, but the stops marked on the lens have different values, according to the degree of enlargement. To find the stop marked on the lens, which has this *f* value, the following equation is employed :—

$$\text{Required stop on lens} = \frac{f \text{ value} \times \text{focal length of lens}}{\text{distance from easel to stop}}$$

Use this stop on the lens.

5. Close the lens or cover up the negative, then pin up the bromide paper (for this a yellow lens-cap is very useful). Now expose the actinometer outside to the light illuminating the negative, and at the same instant open the lens or uncover the negative, and when the actinometer paper has darkened to the standard tint, close the lens.

If you are using an enlarging camera, after inserting the bromide paper and covering the negative or closing the lens, the camera is carried out into daylight and the negative pointed to the sky (do not let the sun shine on the negative). Now hold the mĕter, facing the sky (also out of direct sunlight), and expose as before.

TABLE OF PAPER SPEEDS.

Barnet—Platino matte 12	12
Empire	3
Kodak—Royal, cream-crayon, and white, platino matte rapid	25
Pearl	3
Wellington—Platino matte	12

In finding the opacity number the method is :—Focus the image in the enlarging apparatus so that it is the same size as the negative (or smaller, if convenient). Now, use as a trial slip a piece of paper embracing the whole image; you can then gauge your gradations perfectly, and can see the general effect. This would be impossible with only a portion of the picture. Of course, in arriving at the exposure for the trial slip we gauge the opacity of the negative as closely as we can visually—*i.e.*, compare with the standard negative, and use the foregoing exposure system—most likely it will be very nearly correct in the first exposure. In developing this slip we must develop to the limit, using (say) rodinal with no bromide (rodinal 30 minims, water 1 oz.), or very little bromide. Any developer will do as long as it does not stain and is not rĕstrained. If the resulting print, when viewed by gaslight or subdued daylight after having been fixed, is too dark, we have over-exposed; if it is too light we have under-exposed. In this way we find out our opacity number, then proceed to enlarge to the desired size.

The application of different developers to the making of enlargements, soft or hard, and to dealing with hard negatives, is dealt with at length.—" Aust. Phot. Rev.," May and June, 1905; " B.J.," August 11, 18, and 25, 1905, pp. 627, 648, and 667.

Working-up and Colouring Prints and Enlargements.

Enlargements in Coloured Pastels.—Arthur Whiting recommends the following process for delicacy and solidity :—The prints must be on rough paper : or on canvass, if they are to appear like oil paintings. When a tint is to be laid on heavily the pastel is applied with a hatching movement over the part direct, and then rubbed over smoothly with the finger tips. A stump, or a piece of cotton wool can be used : or better, some portion of the hand. Should the artist's hands be naturally inclined to be damp, the inconvenience may be obviated by rubbing powdered pumice over them.

When only a medium depth of tint is required, it is best to charge the fingers with powdered colour by applying them to the pastel pad, and then working them over the picture, instead of applying the pastel direct. For lighter shades the fingers may be less heavily charged with colour, or a charged stump or cotton wool can be substituted. In pastel work the rule is to put on the necessary depths of tint *at first*, for should the attempt be made to do it by successive applications, it will probably be impossible to obtain the maximum intensity required, as each time one covers the same part with colour the more the surface refuses to take it. Soon after commencing, the beginner will observe the necessity for shading the parts coloured. This is done by applying darker tints of the same colour mixed with a neutral tone to subdue its brilliancy. Should any error of judgment have crept in, the work may be removed with pumice powder applied on the fingers or on cotton wool, although if the tint has been laid on heavily it may be necessary to use either the velvet rubber, or putty rubber charged wtih pumice powder, care being taken in either case not to abrade the delicate surface of the paper.

After the background and accessories have been done, the draperies and hair should be coloured, and finally the flesh, which is by far the most difficult to do.—"B.J.," April 28, 1905, p. 326.

For Rapid Effective Work.—A. Whiting prepares an enlargement on rough paper, and having mounted it and made it quite dry, cleans up with pumice powder, from finger markings, if necessary. The flesh parts should not be pumiced, as it is then difficult to model and clean up these portions well. If they have to be done, the pumice should be well rubbed off with cotton wool. For a vignette, powdered black pastel, No. 27 Serie C. Noir, is tufted over the background, and more lightly over the flesh, and on other parts which need subduing. The heavier shadows are then worked up with a stick of soft paste, softening off with stump or wool. Modelling is done with a soft stump charged with pastel, on the pastel pad, working boldly and remedying any false steps by erasure. The highest lights are put in with soft velvet rubber, smoothing off with wool, impregnated sparsely with cuttlefish powder. Finishing touches are

put in with an H.H. pencil, or with a brush charged with a mixture of Indian ink and Payne's grey. The last stage is to put in the finest high-lights with a retoucher's scalpel, held at almost right angles to the surface of the paper. No Chinese white or crayons are needed, and forty 15 by 12's can be done in a week, the work being devoid of hatching, and the tinting at the first start saving a lot of touching out of imperfections.—"B.J.," January 13, 1905, p. 24.

Enlargements in Semi-Tint.—Arthur Whiting gives the following directions for working up enlargements in "semi-tint." Materials:—Best quality water-colours as follows:—Reds: Madder carmine, burnt carmine, pink madder. Browns: Vandyke brown, bistre, madder brown, brown pink, sepia. Yellows: Aureolin, yellow madder, or gall-stone. Blues: French ultramarine, cobalt, Payne's grey. Greens: Sap green, olive green.

Method of Procedure.—First work out any blemishes in the enlargement and clean up the grain and retouching with lead pencil. The next step is usually to colour the background, and if it is vignetted, some harmonious tint, such as sap or olive green, cobalt or bistre, would be washed over with a large (No. 8) sable brush. In doing this the top of the enlargement might be slightly raised from the horizontal position, but in making the other washes it should be level, to prevent the colours running downwards, and so giving a deeper tint at their lower extremities. Next the hair, draperies, and accessories should be tinted, and finally the flesh. If this is tinted first, it is most difficult to judge the correct depth of colour. Bistre is a most useful colour for brown hair, and very weak washes of the same, with perhaps a faint dash of aureolin or yellow madder, for the fairer shades, or stronger washes mixed with Payne's grey or Vandyke for darker brown. Pink madder will form a useful wash for clear, fair skin, or mixed with burnt carmine, madder brown, brown pink, or yellow madder, for other shades. The tinting must be done more heavily than if the picture is to be finished completely by colours. The cheeks, lips, eyes, jewels, etc., should be coloured sufficiently, but no attempt is to be made in shading.

The enlargement is then finished (when perfectly dry and upon an easel) in black pastel, only that it will not need so much work, and also that the wholesale tinting is not required.—"B.J.," February 3, 1905, p. 84.

Arthur Whiting also treats at length on a method of working up enlargements with both brush and pastel.—"B.J.," March 17, 1905, p. 203.

Fixative for Crayon and Pastel Work.—Arthur Whiting gives the following formulæ for a fixative for both rough and smooth papers, and able to stand dusting and fairly rough usage:—

THE FORMULA.

No. 1.	Mastic	24 grains
	Amyl acetate	3 ounces

Dissolve by agitation, and allow to stand some hours before use.

No. 2. Celluloid (film clippings free from emulsion will do) ...	... ...	7 grains
Amyl acetate	... ...	3 ounces

Dissolve by agitation, and when No. 1 solution is clear, mix both together, and keep for use in a short-necked and tightly-corked bottle.

To apply a fixative, procure a spray diffuser, which is composed of two little pipes, which when opened out for use are at right angles to each other. Place the picture to be fixed in a vertical position, and then insert the end of one of the pipes (the finest one, and made of metal) in the bottle of fixative. Put the other, and larger, tube in the mouth (which must be emptied of saliva and the lips dried), blow through it in the direction of the enlargement, which should be about 15 inches away. The fluid will be brought up through the smaller pipe and sprayed on to it. Direct the spray to the upper edges of the photograph, and then work across and down as rapidly as possible, and using only a very small quantity of fluid, otherwise it will run in unsightly tears down the mount. But in applying it is best to cover the entire enlargement, and not only the part worked up, as in course of time the part not covered may yellow more readily than that which is fixed.

When covered, dry the enlargement by waving in the air, and also rotate it so that the fixative does not dry in curves. If it does, it will leave unsightly glossy lines, and although these may be removed by dabbing (without rubbing), using cotton wool moistened with amyl acetate for the purpose, yet it is far better to avoid having to do so. When surface dry, it should be allowed to stand by for an hour or so to harden, and then it can be subjected to any careful handling without risk of damage, and if properly done it will be found that the fixative has dried in a way so that it is impossible to tell without rubbing whether the picture has been fixed or not.—"B.J., June 30, 1905, p. 506.

Colouring Photographs.—For applying water-colours to the surface of the print, G. Cadogan Rothery recommends the following vehicle :—

Water...	... ...	200 grammes
Gum arabic ...	... ...	16 ,,
35 % spirit ...	... ...	10 ,,
Powdered sugar	... ...	4 ,,
,, alum	... ...	2 ,,

For colouring prints from the back he suggests that the photograph be attached face downwards to a sheet of glass, with a transparent cement. For oil colours, gum arabic answers, but for water-colours, balsam, or a first-class dammar or amber varnish is necessary. The paper back of print is then removed with fine sandpaper,, and what is left is made transparent with melted paraffine wax, or, three applications of castor-oil dissolved in four times its weight of 90 per cent. rectified spirits of wine. The colours are then applied, the light shades first, and then the body colours, and the whole is finally varnished. An alterna-

tive method is to apply the colours to a second piece of paper on which the outline of the print has been traced, and then to place it in register behind the film of the photograph, through which the colours show. A varnish for protecting the front or back of the coloured print, and also of use to cement photographs to glass, is made by fusing together over a water bath, 12 ozs. of white wax, 4 ozs. of Canada balsam, and 2 ozs. of gum elemi.—"Cam.," March, 1905, p. 104.

A Crystoleum Process.—The following modification of this well-known process is suggested. Two prints are made on plain, salted paper—albumen and emulsion papers are not suitable. One print is rendered transparent by soaking in bleached poppy oil, and affixed to a warmed glass plate with a mixture of wax, lavender oil, and Canada balsam. The other is mounted on a stiff card and painted with brilliant colours. It is then placed behind the print on the glass so that the outlines coincide; the result is stated to be similar to painted porcelain. To use this idea for window transparencies, the print must be very deeply printed, and then painted on the back with water-colours, and then made transparent, or painted with oil colours after the print has been rendered transparent.—"Der. Am. Phot.," April, 1905, p. 54.

Lantern Slides.

Flat Slides, according to F. C. Palmer, should be thoroughly washed and bleached in saturated solution of mercuric chloride containing a little acid. Unless the slide is very flat the bleaching should not penetrate to the glass. After again washing, it is darkened in ammonia, of strength such that it has a faint smell only; this may require two or three hours, but is the secret of the process.—"Pgm.," January, 1905, p. 22.

Developer.—Maes gives the following, presumably for gelatino-bromide plates :—Rain water, 125 c. cs.; soda sulphite (anhydrous), 1 mustard-spoonful; potass carbonate (anhydrous), 1 ditto; pyro (Geka), 1 ditto; potass bromide solution (10 per cent.), 6 drops; glacial acetic acid, 6 drops.—"Bull. Belge. Phot.," November, 1904, p. 512. [We insert the above extraordinary formula without comment.—Ed., "B.J.A."]

Matt Surface Plates.—Buntzen suggests the following method of preparing matt surface or so-called "ground glass" emulsion plates, and lay stress on the point that no gelatine which has not the matting substance in it must be coated on the plate. Assuming that 1 kilo. of gelatine is to be used, the following procedure should be adopted :—

Barium chloride	235–435 gms.
Gelatine	1000 ,,
Water...	1000 c.c.s.

Dissolve the barium and heat the solution to 50 degrees C., then add the gelatine and stir till dissolved, then add—

Sulphuric acid, 20 % solution ... ... 500–935 c.c.s.

stirring continuously. Pour out in a dish to set, and break up and wash in the usual way for six hours, then collect, melt, and

measure the volume, and then add the haloids and silver nitrate in the usual way, making allowance for the water that is used. [Equally good results may be obtained by adding to the emulsion when made 50 per cent. of rice starch.—Ed., "B.J.A.].—"Phot. Ind.," July 5, 1905, p. 626.

CINEMATOGRAPH.

Avoiding Fires.—The "Scientific American" diagnoses the chief causes of ignition as follows:—

The film may break below the projection aperture; the feed mechanism may become jammed and inoperative; it may lose its hold on the film; the crank may become loose on the shaft of the feed mechanism so that its turning will not feed the film forward; a small fragment may be torn off the film and lodge in the projection aperture where it will be exposed to the full heating effect of the light; or the operator may stop turning the crank of the film feed mechanism for any one of a variety of reasons. He may become faint or giddy from the heat or from escaping gas; his attention may be suddenly distracted and he may forget to keep the film feed mechanism in motion; or he may stop the feed of the film intentionally and neglect to cut off the light.

To limit any fire which may occur to a few inches of film it is only necessary to inclose both the film supply reel and the take-up reel in fire-proof chambers and to provide valves leading into these chambers through which the film can pass freely while the film feed mechanism is in operation, but which will close instantly when the film feed mechanism ceases to operate or the tension upon the film is relaxed. If the film supply reel and take-up reel are enclosed in such fire-proof chambers or magazines, the ignition of the film at the projecting aperture is a matter of very little consequence, as the burning of the film at that point immediately causes a reduction of the tension on the film and permits the valves through which the film passes into the magazines to close and so prevent absolutely the passage of the flame into the magazines. Properly constructed magazines for the film supply reel and take-up reel can be applied at very small cost to any moving-picture machine, and if the machine is equipped with such magazines it may even be overturned without causing any serious damage.

Other methods of preventing flames at the projection aperture from reaching the reels of film have been proposed, such as non-inflammable plate of considerable size arranged above the projection aperture and extending rearward and to the sides for a considerable distance. Such a plate will sometimes prevent a flame at the projection aperture from reaching the film on the supply reel, but it is by no means as certain in its action as the magazines already mentioned, for the film above the plate is fully exposed, and if the flame rises above the edge of the plate it may strike the exposed film and set fire to the entire reel. Another device which has been proposed to prevent the transmission of a flame from the projection aperture to the film reels consists of a

pair of flat tubes or guides extending above and below the projection aperture and made of non-inflammable material, the idea being that in the small space afforded by these guides for the passage of the film a flame will be extinguished. As a rule, this device operates successfully, but as the reels themselves are exposed, a flame flaring up suddenly at the projection aperture may reach one of the film reels in spite of the guides.—"B.J.," August 18, 1905, p. 650.

VI.—COLOUR PHOTOGRAPHY.

Modified apparatus for the measurement of colour, and its application to the determination of the colour sensations. Sir W. Abney.—"Proc. Roy. Soc.," Series A, Vol LXXVI., No. A 570, p. 315.

C. J. Drac patents a method of colour photography without filters, consisting in splitting up into a spectrum a beam of composite rays by the use of colourless, transparent means, separating such parts of the spectrum as desired, and collecting homogeneous rays into beams of complementary colours, which are caused to act simultaneously on suitably arranged sensitised plates.—"Eng. Pat.," No. 1008, 1904; "B.J." February 10, 1905, p. 111.

Direct Interference Processes (Lippmann).

Gabriel Lippmann finds that an interference colour photograph made on a bichromated film, requires only washing in water to fix it, the colours appearing in the wet film and disappearing on drying. If the film be treated with potass iodide solution, dried without washing, and then treated with 20 per cent. solution soda nitrate, the colours remain brilliant on drying. By transmitted light the complimentary colours are seen giving brilliant negatives. The author also points out the possibility of multiplying prints in colours by contact printing, not on bichromated films, but on gelatino-bromide.—"Compt. Rend.," June 5, 1905; "B.J.," June 30, 1905, p. 505.

Dr. Pfaundler, on mathematical grounds, concludes that if two light-waves of unequal wave-length penetrate the silver bromide film, the two systems of silver separation are optically influenced. The appearance of the dark stripes predicted by

Zenker shows that in the Lippmann process quite a number of colour pairs do not unite to a correct colour mixture, but are neutralised to black.—"Ann. der Physik," 1904, pp. 371 to 384.

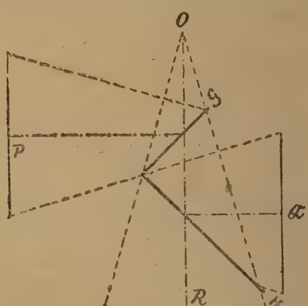
Lippmann Process without Mercury Mirror.—E. Rothé, on the assumption that a thin film of air exists between the coating of emulsion and its glass support, concludes that the separation is enough to prevent reflection—with a difference of phase—without the air of a mirror. In practice this was found to be the case. The exposures given by M. Rothé were, as usual in this process very long, *e.g.*, 30 minutes for an object in the sun, two hours for the same object in a room, and 12 minutes for the spectrum of the arc-lamp. The developer used was weak ferrous oxalate, and the image was bleached with bichloride of mercury, and again blackened with ferrous oxalate.—"Comp. Rend.," "B.J.," November 18, 1904, p. 990.

[Hermann Krone in 1891 stated that the mercury mirror was unnecessary, and merely placed a piece of black velvet in contact with the film, but he ascribed the formation of the stationary waves to a "Zickzackspiegelung" in the glass, and was led to this conclusion by his work in connection with halation.—Ed.]

Three-Colour Processes.

APPARATUS FOR THREE-COLOUR PHOTOGRAPHY.

A Three-Colour Camera.—Hans Schmidt suggests the following construction, obviously not new, for a camera for taking trichromatic negatives. O is the lens, and G is a plain glass reflector at an angle of 45 degrees, and H another reflector at an angle of



90 degrees to G; part of the light is reflected to P, another portion to Q, and the remainder passes through to R. The blue filter and blue-sensitive plate are placed at Q, the green filter and yellow-green-sensitive plate at P, and the red filter and red-sensitive plate

at R. Assuming that one-fifth of the incident light is reflected and putting this at 100, P will receive 20, Q 16, and R 64 parts. In order to equalise the exposure the colour of the filters must be accurately adjusted. To avoid reflections from the back of the plane reflectors, they should be coated with coloured varnishes, that which reflects the blue image with yellow, and the other which gives the green image with an erythrosine stained varnish. —"Cent. Zeit. Opt.," 14, p. 174.

The "Photochrome" apparatus for tri-colour negative making is briefly described by M. Chapelain.—"Bull. Soc. Fr. Phot.," November 15, 1904, p. 521.

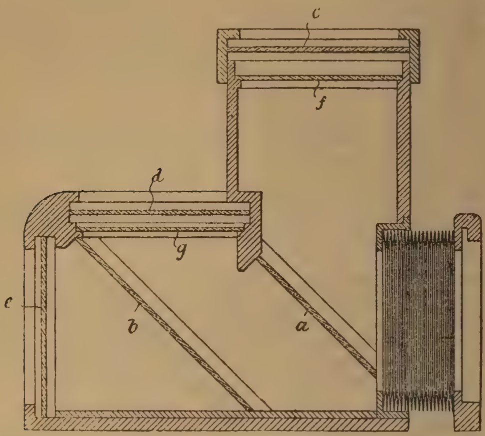
Dr. Miethe's projection apparatus, as made by Goerz, for the exhibition of positives by the method of direct synthesis, is described at length on the occasion of its exhibition in London.— "B.J.," April 7, 1905, p. 268.

Replicas of Diffraction Gratings.—F. E. Ives, in a paper before the Franklin Institute, U.S.A., on the Thorp celluloid replicas, stated that he had made considerable improvements. He makes the casts in a harder and less elastic material than celluloid, and putting them face down upon the glass and forcing them into optical contact therewith, so that the perfect plane of the diffracting surface is preserved, and sealing them up under another plane glass with a balsam mixture having the same refractive index as the casting material, so that the perfect parallelism of the transmitted rays is ensured: at the same time the grating is protected from injury. There is a very slight but even shrinkage of the cast, but after measuring up a large number it was found that it never amounted to more than four or less than two in a thousand, and that by easily established conditions it could be kept very close to either of these figures. Under the conditions finally settled upon, the replicas come out uniformly about 15,050 lines to the inch, and with so little distortion that an expert spectroscopist, working with a large Hilger spectroscope, declared that he could discover no difference in definition between an original Rowland grating and one of these replicas.— "Illus.," March, 1905, p. 361; "B.J.," April 7, 1905, p. 262.

Cameras for Three-Colour.—W. Gamble reviews the various systems of three-colour cameras in regard to the exposure of the three plates. He discusses repeating backs, three-lens and one-lens cameras, and the various devices, mirrors, diaphragms, etc., for obtaining the three negatives at one exposure. The paper includes brief descriptions of the work of Du Hauron, F. E. Ives, T. K. Barnard, MacDonough, Brasseur Sampolo, Szczepanik, J. A. C. Branfil, Sanger-Shepherd, C. D. Aeherns, T. R. Dallmeyer, J. Meyer, E. T. Butler, O. Pfenniger, and Capt. W. N. Lascelles Davidson.—"Phot. Journ.," April, 1905, p. 150.

A One-Exposure Camera.—E. T. Butler patents a one-lens, one-exposure camera of design shown in the figure. The red-sensitive placed is at *e*, and receives the direct rays from the lens coming through the transparent reflectors *a* and *b*. A transmits red,

orange, yellow, and blue, and reflects green and yellow through the green screen *f* to the green-sensitive plate *c*. The yellow screen *b* transmits red, orange, and yellow, and reflects the blue

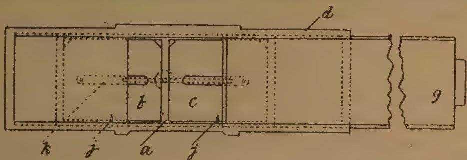


rays through the screen *g* (which absorbs the more active violet and ultra-violet light) to the blue-sensitive plate *d*.—Eng. Pat., No. 4290, 1905; "B.J.," August 11, 1905, p. 633.

E. T. Butler, in a paper before the Royal Photographic Society, further describes this camera, and states that variations in the quantity of violet and ultra-violet light in daylight are so great as to cause disproportion in the relative densities of the blue-sensation negatives exposed at different times. Hence it is best to have these rays completely absorbed, and the best results were obtained with exposures between $\frac{1}{4}$ second and two or three minutes.—"Phot. Journ.," June, 1905, p. 199.

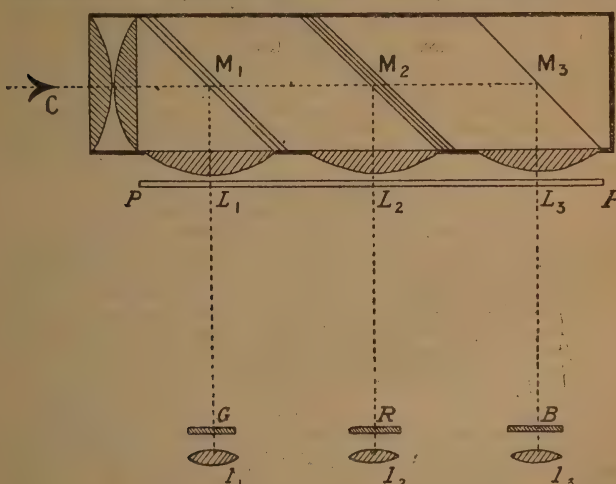
A dark slide for rapidly changing plates and filters is patented by Dr. B. Jumeaux. A carrier, *a*, having two compartments *b* and *c* slides in the grooved frame *d*, the inner length of the groove being equal to one and a half times the length of the carrier *a*. The frame *d* is covered in behind as at *e*, and also at one-third of its length from one end in front, as at *f*, and is provided with the usual draw-shutter *g* at the other end, a stop being provided to prevent it being drawn out further than to expose that one of the compartments *a* and *b* which is at the moment at the centre of the length of the frame *d*, and any suitable means may be employed for bringing the compartments *a* and *b* successively into this central position. A simple and convenient means for thus centralising the compartments consists in providing a longitudinal slot *h* in the back cover *e* in which is free to move a headed pin *i* attached to the centre

of the back of the carrier *a*, the length of the slot *h* being such that when the pin *i* is at one extremity of the slot *h* the compartment *b* will be central, and when at the other end the other compartment *c* will be in that position. In the compartment *b* is inserted a red-sensitive plate with a red filter in front of it, the two being held in place by the catches *j* or any other suitable means and kept in register by the back springs *j*. In *c* is inserted first a green-sensitive plate, then a green filter, and



outside of this an ordinary sensitive plate, face inwards. The slide is inserted in the camera, the shutter drawn, the pin *i* moved to one end of the slot *b*, the lens uncapped and the exposure made, which is suited to the sensitive plate in position. The lens is again capped and the pin run to the other end of the slot, the lens uncapped, and an exposure made on the contents of the other compartment of the carrier.—Eng. Pat., No. 20,827, 1904; "B.J.," September 1, 1905, p. 694.

Three-Colour Projection.—Sir Wm. Abney describes a new



triple lantern for three-colour projection with the arc. The diagram shows its construction.

C is a condenser attached to the end of a metal box. It is four inches square, and when an arc light is placed about six inches from it the rays pass parallel through the length of the box. In their path the rays encounter three sets of mirrors—M_1 and M_2 consisting of three and six patent plate-glasses respectively, and M_3 a silvered mirror. These mirrors M_1 and M_2 reflect a certain portion of the rays, allowing the passage of a residue to M_3, and all three reflected beams fall on secondary condensers, L_1, L_2, and L_3, of such a focus that the image of the carbon points fall on l_1 l_2, and l_3, which are simple spectacle lenses of about 12-in. focus. l_2 is in a fixed position, and l_1 and l_3 have up and down and right and left motions by means of adjustable screws, so that the three images of the transparencies placed at P can be made to overlap on a screen some twenty feet away. (It may be said that the three lenses l_1, l_2, and l_3 have a backward and a forward motion to allow of focussing the images on the screen.) The beam of light is divided into three parts, not greatly differing from each other in intensity when they fall on the screen. The coloured arc images are obtained by placing green, red, and blue screens behind l_1, l_2, and l_3, as shown by G, R, and B. The adjustment for colour is made by altering the number of glasses in M anc M_2 The three-coloured beams, when mixed, should give a white similar to that of sunlight.

When the arc light is at hand this apparatus answers every purpose; but when such a light is not available a modification can be made in a very simple manner. It is only necessary to do away entirely with the mirrors and the big condenser C, and to substitute for the electric light three gas burners or three 50 c.p. lamps, placed at a proper distance behind L_1, L_2, and L_3. In this case the lenses L_1, L_2, and L_3 must be of shorter focus than those shown in the figure, as they have to bring to a focus on l, l_2, and l_3 lights which are comparatively near the condensers. In fact, they should be ordinary cheap oil lantern condensers. The remainder of the apparatus remains as shown.—"Phot.," February 7, 1905, p. 187.

SENSITIZERS.

(See also under "Orthochromatic Processes."

Direct Three-Colour on Dry Plates.—Under conditions, *e.g.*, hot weather, when it is desirable to dispense with collodion emulsion, bathed dry plates may be tried. Of the recent new sensitisers, Homocol appears to be one of the cleanest in working. Almost any plate can be bathed; but for direct work, to give a good dot, with short exposures, we have found Ilford "half-tone" particularly suitable. These can be bathed in :—

Homocol (1-1000 alcoholic solution)	4 parts
Ammonia, .880	3 parts
Distilled water	200 parts

The plates should be bathed for two or three minutes, washed for three minutes, wiped over with cotton wool, and then put to dry in a dark cupboard. After washing, plates can be bathed in methylated spirit (old form) if they are wanted to be quickly dried.—"B J.," May 19, 1905, p. 391.

Hans Schmidt recommends the preparation of photographs in natural colours by using celluloid sheets. Prints in carbon are developed on sheets of transparent celluloid as temporary supports and then transferred to the final paper support. To sensitise the plates the author points out that cyanine is best used in an acidulated bath, and erythrosine in an alkaline bath, and therefore bathes his plates in the former first, and then in the alkaline erythrosine bath: the acid is thus neutralised and rendered harmless. In this way he states he has obtained greater red-sensitiveness than with any commercial panchromatic plates.—"Phot. Mitt.," 43, 1905, p. 39.

PLATES AND FILTERS.

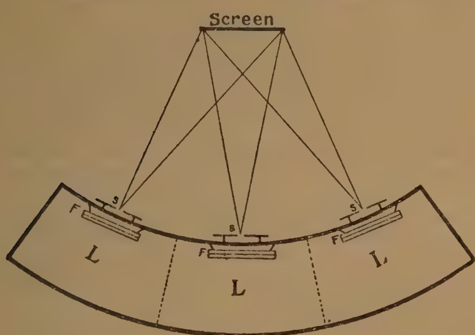
Photographing the Spectrum.—T. Thorne Baker employs the following formulæ for filters of gradual absorptions:—

Blue: Methyl blue, 10 parts; naphthol greeen, 1 part.

Green: Patent blue, 25 parts; naphthol green, 26 parts; tartrazine, 31 parts.

Red: Tartrazine, 70 parts; Titan scarlet, 22 parts.

These filters, used for reproducing the spectrum in colours, correspond within reasonable limits to the theoretically correct ones, and are adapted to the sensibility-curve of the plate employed. Owing to the fact that the yellow printing block is worked first and gives an impression, which sinks into the paper, the latter requires to be stronger than the blue and pink images, and hence



Apparatus devised for estimating accurately the depth of stain in films for superimposition.

the blue-violet filter may record more green than it theoretically should, and may safely pass all rays up to E$\frac{1}{2}$D.

When reproducing the spectrum by transparent stained films, the intensity of the staining was adjusted as follows:—Three boxes, L, L, L, containing equal sources of illumination, are fitted with grooves, F, F, F, into which a "deep shadow" or "opaque"

portion of the film may be placed. When the slits, S, S, S, are equally open and each print properly stained, the screen should appear white. If otherwise, *e.g.*, pink, the pink image is over-stained or the blue and yellow images are under-stained. By closing the slit until the screen appears white, until it is, say, $1/x$th the size of the other slits, we then know that the pink image is x times too deeply stained. It must be then washed out, and tested again.—"Phot. Journ.," January to February, 1905, p. 24.

Ordinary Plates for Three-colour Work.—J. Stenger has tested ordinary plates for three-colour work, and finds that results, alleged to be quite as good as those obtainable on colour-sensitive plates, can be obtained with a ratio of exposures of blue 1, green 750, red 9,000.—"Zeit. f. Repro.," June, 1905, p. 86.

Filters for Three-colour Work.—A. J. Newton and A. J. Bull, as the result of a series of practical and spectrum tests as to the suitability of filters for three-colour reproduction by the half-tone process, conclude as follows :—

1. It is not possible nor is it desirable for any filter and plate to follow either the colour sensation, colour mixture, or certain other calculated curves.

2. The effect of using plates, having maxima with broad banded weak filters, is to cause a degradation of any pure colour occurring in the band of insensibility, therefore plates showing gaps in the spectrum record should not be used for the green negative.

3. Ultra-violet should not be recorded, as it will exercise a disturbing effect where it is reflected by colours other than blues and violets, as is the case with some browns, scarlets, and yellows, these reproducing with a distinct bluish tint.

4. As much red should be recorded as possible; ethyl violet in collodion emulsion, or pinachrome bathed dry plates, at present give the best record of red.

5. There should be no unrecorded gaps in the visible spectrum, for while these may not be important, for certain mixed colours of pale tints, they are fatal to correct rendering of colours whose spectra do not extend beyond the gap.

6. The filter records should be even, end abruptly, and overlap each other as follows : the blue-violet and the green should overlap from 4,600 as far as 5,000, and the red and green should overlap from 5,800 to 6,000.

Filters prepared on these lines are as follows (in each case the filter is used liquid in a cell of 5 mm. separation) :—

For use with collodion emulsion, with known sensitisers, *e.g.*, Albert's emulsion with 4 c.c.s. 1 in 500 alcoholic solution of pinaverdol per 100 c.c.s. for the yellow and red printers and 2 c.c.s. 1 in 500 alcoholic solution for ethyl violet per 100 c.c.s. for the blue printer.

Blue filter contains :—

Quinine sulphate (solution effected with acetic acid)	0.5 per cent.
Victoria blue	0.1 ,,
Crystal violet	0.005 ,,

This cuts out all but between 4,000 to 5,000. This filter, however, is not stable, and must be freshly made to give this absorption.

Green filter contains :—

Naphthol green	0.4 per cent.
Naphthol yellow	0.04 ,,

This records from 6,000 to 4,800.

Red filter contains :—

Fast red	0.05 per cent.
Tartrazin	0.25 ,,

This records from 5,800 to near the end of spectrum.

For the dry plates (indirect method) :—

Blue filter, 0.5 per cent. quinine sulphate, used with a Castle plate.

Red filter, 0.25 per cent. Biebrich scarlet, used with a Lumière C plate.

Biebrich scarlet is not the best dye to use, owing to its requiring some alcohol to dissolve it. Better is :—

Fast red	0.5 per cent.
Tartrazin	0.25 ,,

This is made up to give exactly the same absorption.

In this set the green filter is acid green 0.05 per cent., quinine sulphate 0.5 per cent., used on a Westendorp and Wehner orthochromatic plate.

This green filter was adjusted to a typical erythrosine plate, with its band of insensibility in the blue-green, so as to fill up this gap as far as possible, and at the same time to render perfectly the three inks used for printing. This set of filters is of interest in that, while they will reproduce the printing inks perfectly, they fail on other colours.

The same red and blue filters, given above, are used with a green filter made up as follows :—

1 per cent. solution of fast green B.S. ...	1.5 c.c.s.
1 per cent. solution of tartrazin	1.5 ,,
1 per cent. quinine sulphate	100 ,,
Water up to	200 ,,

This green filter was used with the "Spectrum" plate, and was designed to give an even record throughout the yellow, green, blue, and violet of the spectrum, in order to prevent the crimson ink from printing in the blues, since, owing to the want of transparency of crimson printing inks to violet and the transparency to some extent of blue printing inks to red, the result obtained by printing these together is often not what it should be—a blue-violet colour—but a dark purple.

With these filters the dark blues are somewhat too light with the inks used, but with the usual commercial blue inks they would be better. The two colours upon which this filter fails are yellow and green, neither being sufficiently recorded in the green negative by the time the whites are fully exposed, the

blue and violet of the white rcording as well as the green, the result in each case being the printing of too much crimson.

Another green filter is designed to record evenly between 5,000 and 6,000. In this green and the next the records are pretty even throughout the exposures. The filter was made up of equal parts of naphthol yellow S.L. (saturated solution in water) and 0.02 per cent. naphthol green, and was used with the Spectrum plate. With this filter one would expect to see blues too dark, but the advantage of a narrow even green, correctly placed, is that average greens will be fully recorded on a normally exposed subject. Practically all colours were fairy well rendered by this except the dark bues, which were too violet, because they are not sufficiently recorded in the green negatives.

The green filter in this case records the yellow, green, and blue of the spectrum up to 4,600, where it commences to change to violet. The plate used for the green negative was again the "Spectrum," and the composition of the filter was as follows:—

Naphthol yellow	0.03 per cent.
Naphthol green	0.01 ,,

This filter gave the best general rendering of all those tried, the dark greens were rendered as green only with this and the preceding green filter.—"Phot. Journ.," October, 1904; "B.J.," December 16, 23, and 30, 1904, pp. 1068, 1089, 1106.

A further paper, giving the regions of sensitiveness of a number of commercial plates and of plates sensitised with various dyes, appears in "Phot. Journ.," January-February, 1905, p. 15; "B.J.," 1905.

ONE-PLATE THREE-COLOUR PROCESSES.

Lumière's Starch-Grain Process.—A. and L. Lumière obtain photographs in natural colours by their starch-grain process as follows:—The sheet of glass is coated with suitable adhesive and a layer of coloured transparent grains applied to it. The grains may be of starch, and the colours used should also be transparent. Three equal weights of the grains are coloured respectively red, yellow, blue, and are mixed as intimately as possible. The layer of grains should be so applied that the grains touch each other without being superimposed. This layer is covered with a second adhesive coating, a second layer of coloured grains applied, and the whole covered with a varnish. The sensitive film is then applied to the prepared plate in the usual way. The varnish and the adhesive should have approximately the same refractive index as the transparent grains in order that the light may not be deflected or diffused. The plate is exposed in the camera with its glass side to the lens, is finished in the usual way, and is reversed. On viewing the finished plate by trasmitted light a reproduction in colour is obtained.—Eng. Pat., No. 22,998, 1904; "B.J.," January 6, 1905, p. 10.

The coloured particles for preparing the plates may consist of a mixture of red, yellow, and blue particles (with orange, green and violet as well, if desired), or a mixture of these with any

other coloured particles may be employed. Two layers of such particles are not absolutely necessary; the desired result may be obtained by coating the plate with a layer having at no point of its surface any superimposed particles. The coating may also be formed of particles of different sizes; the larger particles may be applied first and the smaller ones dusted on afterwards so as to fill up the interstices between the larger particles. These smaller particles may be of similar colours to the larger ones, or of any other colour, even black.—Eng. Pat., No. 25,718, 1904.

The Joly Process.—A modification presumably, of the Joly process is that of John H. Powrie, of Chicago, who prepares a commercial plate (the "Florence") with the filter-bands by a photo-mechanical process, and then coats with a panchromatic emulsion. The result is a negative with colours, as well as light and shade, reversed. Positive prints or lantern slides are printed from these negatives.—"Illus.," April, 1905, p. 389.

One-Plate Colour-Photography.—Dr. J. H. Smith patents a compound photographic plate or film, carrying two or more colour-sensitive emulsions insulated from each other so that they can be separated after exposure for development singly. The plates for which protection is thus claimed, in English Patent, No. 19,940, 1904, are placed upon the market for the production of the three colour-sensation negatives at one exposure. They are intended to be used without filters of any kind, and are stated to have a rapidity of about 12 H. & D., sufficient for short exposures under the best conditions of lens and lighting. For development the three films are separated, for which purpose the plate is placed in a special frame, and covered with a sheet of black paper, carried on a small sliding bar, which is so arranged that the extreme corner of the plate is left uncovered. For the next operation, candle-light may be employed. The two top films are cut through with a sharp knife, and gently lifted free of the bottom film. Then, in a dim red light, the top films and the black paper are pulled back together, and stripped off. These two films will consist of the top and the second gelatine films, giving two final plates with a collodion film between them. Hence, provided a developer can penetrate to both sides—the film being held vertically in a clip—these two films can be developed at once, and stripped apart when dry. The bottom film remaining on the plate has a layer of collodion on top of it, which must be removed before development by soaking the plate for five minutes in methyl alcohol (not methylated spirit).—"B.J.," September 15, 1905, p. 722.

TRANSPARENCIES BY THE INDIRECT (DYE) PROCESS.

Transparencies from Screen-Negatives.—F. E. Ives makes from the red sensation screen-negative a bichromated fish-glue print on glass, and stains it an aniline blue bath to serve as a ground for the other colours. After varnishing, it is coated with gelatine and bichromate, exposed through blue sensation negative, and stained yellow. The cover glass of the slide is likewise sensitised,

printed from the (reversed) green sensation negative, and dyed in crimson.—"Pgm.," December, 1904, p. 181.

Three-Colour Transparencies.—E. T. Butler, in preparing dyed transparencies by the indirect process finds it best to dye the plate, coated with plain gelatine, prior to sensitising with bichromate. It is then possible to follow the development of the image more easily even than when a silver salt is contained in the gelatine. The dyes used, besides having the correct absorption properties, must be miscible with the sensitiser without being decomposed and soluble enough to wash out of the print by soaking (for purposes of adjustment), but not so soluble as to "run" during development.

A strong dye bath and short immersion flash the colour all over, providing there is no bare glass, and so make the print flatter. A weaker dye bath and prolonged dyeing, with a short wash afterwards, promote contrast. Contrast is also promoted by washing in clean water, if a preponderance of colour is shown in any of the prints. If the greys are grey and the blacks black, the gradation of colour should come right. In making the positives it is found best to convert a silver image into Prussian blue by bleaching in potassium ferricyanide, and treating the bleached image with ferric chloride. Magenta is used for the red image, and aniline yellow for the yellow. An alternative practice is to use 10 parts of methyl blue with one part of naphthol green for the blue, fuschine for the red, and naphthol yellow for the yellow image; but the results are not equal to the foregoing.—"Phot. Journ.," June, 1905, p. 199.

THREE-COLOUR PROCESSES ON PAPER, ETC.

Pinatypy.—Dr. König of Meister Lucius and Brüning, describes his new process for obtaining prints in natural colours on paper. A sheet of glass, coated with a special adherent gelatine film is sensitised with bichromate, dried and exposed under a transparency. After exposure, the plate is well washed to remove the bichromate, and an image is obtained in hardened and normal gelatine. The plate is now soaked in a special "pinatype" dye solution, which penetrates the unaffected gelatine, but does not touch that hardened by light. After 15 minutes' immersion the plate is rinsed with water. A sheet of special paper is now soaked in water and squeegeed into contact with the dyed plate, left for 10 or 15 minutes, then stripped, and the image is transferred in this manner to the paper. The plate has now only to be re-soaked in the dye solution for about 5 minutes, and further pulls may be taken from it. The plate may be dried and stored and used again at any time. For obtaining prints in natural colours, the positives must naturally be taken through suitable trichromatic screens, and the blue plate printed in yellow, the green in red, and the orange in blue. The superposition of the impressions presents no difficulty, and this process can be used for making large prints, as naturally large positives can be used. There is, of course, some general objection to the use of aniline dyes, on account of their generally assumed fugitive character,

but Dr. König has exposed some of his prints for three months in winter, and to such sunlight as was available, and they show no sign of fading.—"Phot. Mitt.," March 1, 1905, p. 65.

The following is an abstract of further instructions for this process of producing prints in colours on paper, discovered by Dr. König, and introduced commercially by Meister Lucius and Brüning. Three negatives are obtained in the ordinary way for trichromatic work, and from them three transparencies are made by contact or enlarging. The developer recommended for these transparencies, which should have a normal lantern slide character, but preferably rather soft than hard, is :—

1.	Pyrocatechine	22 gms.
	Sodium sulphite	50 ,,
	Water	1000 c.c.s.
2.	Potass carbonate	120 gms.
	Water	1000 c.c.s.

For use, mix 1 part No. 1, 1 part No. 2, and 1 part water. Special gelatinised plates are obtained, and these are sensitised in a 2 per cent. solution of "chromic salt" for three or four minutes and then dried. These are exposed under the positives, the duration of exposure being regulated by an actinometer, as in ordinary carbon work, and after exposure freed from the bichromate by washing. The images thus obtained may be dried or used wet. That from the negative through the red screen is dyed in a 5 per cent. solution of blue F. by immersion for 15 minutes, then rinsed and squeegeed into contact with the special transfer paper, and left in contact for 10 or 15 minutes, the paper stripped and hung up to dry. The red image is obtained by dyeing the relief image corresponding to the negative taken through the green screen in a 5 per cent. solution of red F. rendered alkaline with ammonia and treated as described for the blue, and the dyed plate placed in accurate register on the top of the blue image. The yellow image is obtained in the same way, using a 5 per cent. solution of yellow F., and treated in the same way. When complete, the picture is immersed in a 2 per cent. solution of the "fixer," which hardens the gelatine and improves the colours. The order of printing should be blue, yellow, red, or red, blue, yellow. The colours may be reduced by squeegeeing the print to a gelatinised plate, and leaving them in contact for a short time: and intensified by merely re-applying the dyed plate. Retouching may be effected by a brush charged with colour. Prints may be enamelled by any of the usual processes. The relief positives may be repeatedly used, forming a sort of printing-matrix.—"Mon. Phot.," May 15, 1905, p. 146.

Working instructions for the pinatype process are printed in the "B.J.," September 22, 1905, p. 749.

Leuco Dyes.—Meister Lucius and Brüning claim protection for (1) the manufacture of sensitive surfaces for photography by applying the leuco body from an organic dye in admixture with a compound containing one or more loosely combined nitro groups. (2) The use of a carrier of oxygen to enhance sensitive-

ness. (3) Sensitive surfaces prepared according to (1) and (2). (4) A photographic process on these lines; the image being fixed in a solvent of the leuco-dye; and (5) and (6), the application of the process to three-colour photography. Suitable nitro bodies are the nitro acid esters of carbohydrates such as the so-called nitro-cellulose, nitro-glucose; also nitrosamines, such as those of methyl-phenyl, and diphenyl. The solvents of the leuco bodies, which serve as fixing agents, are hydrocarbons of the benzine series, chloroform, carbon tetrachloride, and weak organic acids, particularly monochloracetic acid. The carriers of oxygen mentioned by the patentees are platinic chloride, aniseed oil, turpentine oil, and quinoline and its homologues. By this process leucaniline yields a red image, hexamethyl-para-leucaniline, a blue-violet image, the leuco-bases of the malachite green series, a green to blue image, and the leuco bodies of flavaniline, uranine and the like, yellow images. The examples of the process given in the patent (No. 4994, 1904) need not be quoted, as the process has already been described at length in "The British Journal of Photography," October 14, 1904, p. 886, and October 21, p. 908.

Multiple Tissue.—Adolf Hesekiel proceeds as follows in preparing compound tissue to produce single or double transfer prints in colours at one operation from ordinary negatives. The tissue consists of layers of pigmented gelatine arranged in the order, from back to front of the paper, of blue, yellow, green, red, and black; the most transparent being uppermost, and the more opaque underneath. This arrangement is recommended for landscape negatives, but in order to prevent the blending of the colour of adjacent films, other layers of contrasting colours are interposed, and the series of films may run as follows, from top to bottom:—Blue, greyish pink, yellow, red, green, and black, with a deep red non-actinic film below this to prevent the picture adhering to the paper. To form the printing surface, the paper or other support has applied to it the different gelatine solutions in succession, each layer being allowed to set and dry before the next is applied, so that the adjoining layers will not mix. In making a printing paper, for instance, the strip of paper is carried on rollers and is run successively through baths of different coloured gelatine solutions. The thickness of the layers may be adjusted by varying the speed of the paper, and the temperature of the bath. Thus with a quick speed of the rollers and a low temperature a thick coating will be obtained and *vice versâ*. The colours employed are of the usual kind for colouring pigment or carbon papers.—Eng. Pat. No. 4941, 1904; "B.J.," January 27, 1905, p. 73.

Trichromy via Chemical Toning.—Herr Reichel prints from the three colour-sensation negatives on to stripping chloride paper and suitably tones each of these positives. For the red image a sulphocyanide gold bath with sodium iodide and potash is used. The yellow print is made by toning with lead, and the blue with iron salts. The several monochromes are transferred one onto each other, and fixed with glue. A sheet of glass is now coated

with a special preparation, and one of the prints is squeegeed into contact and dried, and then the paper soaked in benzole and stripped. The second print is superimposed on the coloured transparency obtained from the first, and the paper again stripped. The third print is now squeegeed on the other two, and when dry the three impressions are stripped from the glass.—"Chem. Zeit." (Rep.), November 19, 1904, p. 348.

A pigment paper for the printing of trichromes is patented by C. L. A. Brasseur, its advantage being that one film can be applied to another cold, thus giving a composite print in which one film does not stain another. The claim is for a "carbon transfer paper," consisting of a flexible support, a film of coloured soluble gelatine, and a film of easily soluble matter between the two. The upper layer consists of gelatine with perchloride of iron and tartaric acid, and is insoluble until exposed to light. The intermediate coating is of gum, albumen, wax or varnish. Once the carbon transfer is made, it may be used at any time; since the colour is fixed, the paper may be wetted in cold water, and be squeegeed on the surface on which it is to be printed. After being squeegeed upon the last-mentioned surface, the paper is removed, leaving an absolutely uniform film of a predetermined colour ready to be sensitised and printed under the negative, after which the unacted-upon parts are removed. After impermeabilisation or other protection of the print so made, another film may be squeegeed upon the support, overlying the first, and is then sensitised, printed, developed, and washed without staining the underlying image or print. since the second film is put on cold. After the impermeabilisation of the second print, a third film may be transferred, be sensitised, printed, etc., thus giving a final composite print in which no one film is stained or dscoloured by another.—Eng. Pat., No. 21,208, 1904; "B.J.," September 1, 1905, p. 694.

Celluloid Pigment Films for Three-Colour Prints.—H. O. Klein, in working this process with the pigment films of the Rotary Photographic Company, first sensitises his own plates in a bath of :—

Pinachrom (solution, 1 : 500 alcohol)	2	c.c.s.
Ammonia	2	,,
Distilled water	200	,,

After immersing for two minutes, wash the plates under the tap for about five minutes and dry in a drying cupboard. It is essential that the plates are dried quickly. The commercial filters are used, or gelatine coated glass plates dyed in the following baths :—

BLUE FILTER BATH.

Methylene blue (½ per cent. solution)... ...	20	c.c.s.
Water	2)	,,

Green Filter Bath.

Methylene blue N. (½ per cent. solution) ...	5 c.c.s.
Auramine G. (½ per cent. solution)	30 ,,

Red Filter Bath.

Erythrosine (½ per cent. solution)	18 c.c.s.
Metanile yellow (saturated solution)	20 ,,

The films are sensitised in a potass bichromate bath, about 3 per cent. strength, or 4 per cent. for strong negatives, and 1 per cent. for weak negatives. The dried films are printed from the negatives through the celluloid, being timed in the usual way with an actinometer. They are developed in water, not warmer than 85 degrees F., and then assembled as follows :—The white paper support receives the yellow image first. The yellow film is laid in a dish with cold water for about fifteen minutes, then the white three-colour mounting paper is immersed for about one minute, the film floated on to it, squeegeed, and left under pressure between filter paper for fifteen minutes, then pinned up to dry.

When dry, the celluloid is stripped off the yellow print and the latter freed from the coat of india-rubber by rubbing the image with a pad of cotton wool charged with benzole. Next, the blue print is transferred on to the yellow, but it will be found necessary to coat the print with gelatine to make the blue adhere.

The following solution is made up :—

Gelatine	300 grs.
Warm water	30 ozs.

To the solution add—

Chrome alum 10 per cent.	½ oz.

The yellow print is immersed in cold water, and as soon as it presents a flat appearance put on a glass plate covered with gelatine solution and registered by gentle movement of the blue print. Now squeegee, leave under pressure for fifteen minutes, hang up to dry. Strip the celluloid, clean again with benzole, immerse in water, coat with gelatine, transfer the red print, etc. Last of all, the finished colour print is rubbed over with benzole, trimmed, and mounted like an ordinary photograph. The prints can now be printed and retouched with colour obtained by dissolving the coloured gelatine of the tissue.—" B.J.," September 29, 1905, p. 768.

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The Actinism of Colours in Daylight.—Precht and Stenger have been examining this question. A set of tri-colour screens were used, which transmitted respectively :—Blue, λ 410 – 490 ; green, λ 505 – 580 ; orange, λ 570 – 725.

The following tables give some excerpts from their experiments :—

TABLE I.

Date.	Time	Place.	Weather.	Relative Density. Blue : Green : Orange. Measured.	Relative Density. Blue : Green : Orange. Calculated for Blue=1.	Exposure Ratio.
27/10/04	a.m. 11	In open	Sun, clear, bright day	0.388 : 0.380 : 0.392	1.0 : 0.98 : 1.01	1 : 3.2 : 8.8
27/10/04	a.m. 11.10	In room	In shade	0.359 : 0.273 : 0.300	1.0 : 0.76 : 0.83	1 : 5.6 : 14.0

Conclusions.—All the conditions being kept equal, the exposure in the shade shows a relatively stronger decrease in the actinism of the orange and green than of the blue.

TABLE II.

Date.	Time	Place.	Weather.	Relative Density. Blue : Green : Orange. Measured.	Relative Density. Blue : Green : Orange. Calculated for Blue=1.	Exposure Ratio.
16/11/04	a.m. 11.45	In open	Clear, sunny aut'mn day	0.455 : 0.472 : 0.473	1.0 : 1.04 : 1.04	1 : 2.7 : 8.1
16/11/04	p.m. 3.50	In open	In shade	0.718 : 0.642 : 0.644	1.0 : 0.89 : 0.90	1 : 4.0 : 11.7

Conclusions.—The extraordinary inequality of the exposures in the open produced a considerable deficiency of green and orange action with decreasing actinism.

TABLE III.

Date.	Time	Place.	Weather.	Relative Density. Blue : Green : Orange. Measured.	Relative Density. Blue : Green : Orange. Calculated for Blue=1.	Exposure Ratio.
15/11/04	a.m. 10.45	In room	Clear, bright	0.864 : 0.828 : 0.863	1.0 : 0.96 : 1.0	1 : 3.3 : 9.0
17/11/04	a.m. 10.30	In room	Dull, cloudy	0.263 : 0.210 : 0.177	1.0 : 0.80 : 0.67	1 : 5.1 : 21.3

Conclusions.—Under equal conditions of exposure in clear and very cloudy weather at the same time of day, a strong reduction of the green, and a still stronger reduction of the orange, is shown.

As regards these three tables, it should be noted that the values in each are rigidly comparable, as the two exposures were made on the same plate.

The numbers in the last column show what should have been the ratio of exposures in order to obtain an equal density of 1 behind all three filters, instead of 1 : 3 : 9, which were used. The authors proceed to discuss the ratio between exposure and density, and promise further communications, and state that the general assumption that the density is directly proportional to the time of exposure does not hold good for three-colour work.—"Zeit. für Wiss. Phot.," February, 1905, p. 27; "B.J.," March 24, 1905, p. 226.

Key to the abbreviations of journals quoted in "Epitome of Progress" with addresses of those published in Foreign Countries:—

"Der Am. Phot." .. "Amateur Photograph, Der" (now "Photographische Welt").
(M. Eger), 29, Grimmaischer, Steinweg, Leipsic, Germany.

"A. P." .. .. .. "The Amateur Photographer."

"Amer. Am. Phot." .. "The American Amateur Photographer."
361, Broadway, New York City, U.S.A.
Molkteplatz 10, Dresden A, Germany.

"Ann. Gen. Prot." ... "Annuare Général de la Photographie."
Plon-Nourrit & Co, 8, Rue, Garancière, Paris, France.

"Ap. Ann. Chem. Phys." "Apollo Annales de Chimie et de Physique."
Masson & Co., 120, Boulevard St. Germain, Paris.

"Atelier" .. .. "Das Atelier."
W. Knapp, Halle a/Saale, Germany.

"Aust. Phot. Journ.".. "Australian Photographic Journal."
Harrington & Co., Ltd., 386, George Street, Sydney, Australia.

"Aust. Phot. Rev." .. "Australian Photographic Review."
Baker & Rouse Proprietary, Ltd., 375 George Street, Sydney, Australia.

"Berichte" .. .. "Berichte der Deutschen Chemischen Gesellschaft."
R. Friedländer & Sohn, Karlstr. 11, Berlin, N.W.

B. J." .. .. .. "The British Journal of Photography."

"B. J. A." .. .. The British Journal Photographic Almanac."

"Brit. Opt. Journ." ..	"The British Optical Journal."
"B. M."	"The Bromide Monthly and Photo Notes."
"Bull. Soc. Fr. Phot."	"Bulletin de la Société Française de Photographie." Gautier-Villars & Sons, Quai des Grands-Augustins, 55, Paris, France.
"Bull. Belge"	"Bulletin de l'Association Belge de Photographie." M. C. Puttemans, Palais du Midi, Brussels.
"Bull. Fr. Chem. Soc."	"Bulletin of the French Chemical Society." Masson et Cie, 120, Boulevard St. Germain, Paris.
"Cam."	"The Camera." 123, S. 11th Street, Philadelphia, Pa., U.S.A.
"Cam. Craft"	"Camera Craft." 112, Geary Street, San Francisco, Cal., U.S.A.
"Cam. and Dk. Rm." ..	"Camera and Dark Room." 30, Cortlandt Street, New York, U.S.A.
"Chem. News" ..	"The Chemical News."
"Cent. Zeit."	"Central Zeitung für Optik und Mechanik." 7, Bülow Str., Berlin, W., Germany
"Compt. Rend." ..	"Comptes Rendus des Seances de l'Academie des Sciences." Gautier-Villars, 55, Quai des Grands-Augustins, Paris.
"Chem. Zeit."	"Chemiker Zeitung." Dr. G. Krause, Cöthen, Germany.
"D. Phot. Zeit." ..	"Deutsche Photographische Zeitung." K. Schwier, Weimar, Germany.
"Eder's Jahrbuch" ..	"Jahrbuch für Photographie und Reproduktionstechnik." W. Knapp, Halle a/S., Germany.
"Focus"	"Focus."
"Oest. Phot. Zeit." ..	"Oesterreichische Photographen Zeitung." Oesterreicher Photographen-Verein, Vienna III/I.
"Illus."	"The Illustrator." Beekman Buildings, New York, U.S.A.
"Il Prog. Foto." ...	"Il Progresso Fotografico." R. Namias, 27, Via Boccaccio, Mailand, Italy.
"Journ. Chem. Soc. Trans."	"Journal of the Chemical Society: Transactions."
"Journ. Phot. Soc. Ind."	"Journal of the Photographic Society of India." 40, Chowringhee, Calcutta, India.
"Journ. Roy. Micr. Soc."	"Journal of the Royal Microscopical Society."
"Phot. Journ." ..	"Journal of the Royal Photographic Society of Great Britain" ("The Photographic Journal").
"Journ. Soc. Arts" ..	"Journal of the Society of Arts."

"Journ. S. C. I."	..	"Journal of the Society of Chemical Industry."
"Knowledge" ..	..	"Knowledge."
"Phot. Kunst"	..	"Photographische Kunst." Heustrasse 18, Munich, Germany.
"Lech. Mitt." ..	..	"Lechners Mitteilungen." 41, Graben, Vienna, Austria.
"Mon. Phot." ..	..	"Le Moniteur de la Photographie." 7, Rue Scheffer, Paris, France.
"Nature" ..	..	"Nature."
"N. Z. Phot." ..	..	"Sharland's New Zealand Photographer." Lorne Street, Auckland, N.Z.
"Opt."	..	"The Optician."
"Opt. Lant." ..	..	"The Optical Lantern and Cinematograph Chronicle."
"Pharm. Journ."	..	"The Pharmaceutical Journal."
"Phil. Mag." ..	..	"The Philosophical Magazine."
"Phil. Trans."	..	"Philosophical Transactions of the Royal Society."
"Photo-Beacon"	..	"The Photo-Beacon." Security Building, Chicago, Ill., U.S.A.
"Photo Gazette"	..	"Le Photo Gazette." 83, Rue Demoures, Paris, France.
"Le Phot." ..	..	"Le Photo Journal." 22, Rue Vurenna, Paris.
"P. M."	..	"The Photo-Miniature." 289, Fourth Avenue, New York, U.S.A.
"Photo-Revue"	..	"Photo-Revue." 118, Rue d'Assas, Paris VI, France
"Photo-Era" ..	..	"Photo-Era." 170, Summer Street, Boston, Mass., U.S.A.
"Pgm."	..	"The Photogram."
"Phot. Franc."	..	"La Photographie Française." M. H. Grand, 13, Rue de la Rivière, Lafoullon, Puteaux-sur-Seine, France.
"Photographer"	..	"The Photographer." 21 and 26, East 21st Street, New York, U.S.A.
"P. N."	..	"The Photographic News."
"Phot. Scraps"	..	"Photographic Scraps."
"Phot. Times"	..	"The Photographic Times." 39, Union Square, New York City, U.S.A.
"Photographie"	..	"La Photographie." 295, Rue St. Jacques, Paris, France.
"Phot. Chron."	..	"Photographisches Chronik." W. Knapp, Halle a/Saale, Germany.
"Phot. Korr." ..	..	"Photographisches Korrespondenz." 7, Carmelitergasse, Vienna II.
"Phot. Mitt." ..	..	"Photographische Mitteilungen." Gustav Schmidt, Königin Augustastr. 28 Berlin, W. 10, Germany.
"Phot. Indus."	..	"Photographische Industrie, Die." Dresden—A., 21, Germany.
"Phot. Rund."	..	"Photographische Rundschau." W. Knapp, Halle, a/S. Germany.

"Phot. Woch." ..	"Photographisches Wochenblatt." 13, Bendlerstr., Berlin, W.
"Phot."	"Photography."
"Phys. Rev."	"The Physical Review." Ithaca, New York, U.S.A.
"Procédé"	"Le Procédé." 150, Boulevard de Montparnasse, Paris XIV.
"Proc. Roy. Soc." ..	"Proceedings of the Royal Society."
"Process Pgm." ..	"The Process Photogram."
"Pro. and Am. Phot."	"The Professional and Amateur Photographer." 222, Washington Street, Buffalo, U.S.A.
"Pract. Phot." ..	"The Practical Photographer."
"Rev. Phot."	"Revue de Photographie." Photo Club de Paris, 44, Rue des Mathurins, Paris, France.
"Revue des S. Phot." ..	"Revue des Sciences Photographiques." Chas. Mendel, 118, Rue d'Assas, Paris, France.
"Rev. Suisse"	"Revue Suisse de Photographie." 23, Escaliers du Marche, Lausanne, Switzerland.
"Sci. Amer."	"The Scientific American." Munn & Co., 361, Broadway, New York U.S.A.
"St. L. and C. Phot."	"The St. Louis and Canadian Photographer." 3210, Locust Street, St. Louis, Mo., U.S.A.
"St. Ver."	"Saint Veronica." Dr. Geo. Ewing, Merlin Park, Old Ballygunga, Calcutta, India.
"Wiener F. Photo. Zeit."	"Wiener Freie Photographen Zeitung." Gustav Walter, Payergasse 13, II/16 Vienna, Austria XVI/I.
"Wilson's"	"Wilson's Photographic Magazine." 289, Fourth Avenue, New York, U.S.A.
"Yr. Bk. Phot." ..	"The Year Book of Photography."
"Zeit. für Instr." ..	"Zeitschrift für Instrumentenkunde." Julius Springer, Berlin.
"Zeit. für Repro." ..	"Zeitschrift für Reproduktionstechnik." c/o Wilhelm Knapp, Halle a/Saalè, Germany.
"Zeit. für Wiss. Phot."	"Zeitschrift für Wissenschäftliche Photographie." J. A. Barth, 17, Rofsplatz, Leipsic, Germany.

INDEX TO NOVELTIES.

RECENT NOVELTIES IN APPARATUS, &c.

(*Continued from page 645.*)

THE "SIBYL" POCKET CAMERA.

(Made by Newman and Guardia, 90 and 92, Shaftesbury Avenue, London, W.)

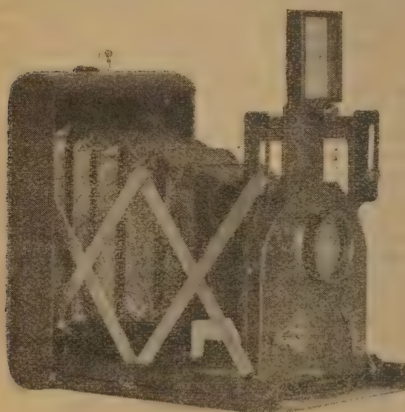
The description "pocket camera" has been an elastic one as used by makers of cameras for which great portability has been claimed. There have been cameras which themselves were of pocketable size, but required the attachment of roll-holder, or changing box, before they were ready for work. On the other hand, there are instruments which are certainly small enough when completely equipped for photography, but the size of picture taken is too small for anything but enlarging, and often the camera lacks the range of movements which the average run of hand-camera work absolutely demands. Messrs. Newman and Guardia have manufactured a camera—the "Nydia"—which might reasonably claim the right to be a pocket instrument, but they have now designed a new form of folding camera which they claim to be the embodiment of all the qualities which man can reasonably ask for in an instrument to be carried in his pocket, always ready for work, and yet of such size that he will not feel its weight or bulk any more than that of his cigar-case. These are large claims to make, but they are none the less borne out in the camera which we have inspected—the first, we believe, to be shown to any one outside the firm. To what extent Messrs. Newman and Guardia will do business with those who must have a small and yet perfectly practicable instrument can best be judged by pointing out that in the "Sibyl" they offer a camera which:—

1. Measures 5 by 5⅝ by 1 3-16 in., including the slide carrying a plate ready for exposure.
2. Is without a single projection or exposed piece of mechanism when folded for the pocket.
3. Permits focussing up to 2 yards, and can be set to come to any focus on opening the camera.
4. Has a vertical rise of front three-quarters the length of the picture.
5. Carries finder showing an image but little less than half that obtained in the camera.
6. Is fitted with a shutter giving exposures from ½ to 1-100th second.

The general appearance of the camera, open and closed, will be seen from the two figures. The size of plate is the 3½ by 2½ in., and the dark slide is so made that the full plate is exposed up to the edges with the exception of ⅛th in. at one end. The picture

thus differs from the quarter-plate only by $\frac{1}{4}$ in. all the way round. As the figures show, the method of extension adopted in the "Sibyl" is the lazy-tongs, permitting the front to remain anywhere between its two limits of movement. The front is not dependent on runners for its guidance, and thus requires scarcely any inducement to leave the back, on the base-board cover being opened. The point at which it stops is controlled by the separate focussing adjustment—that is to say, the camera can be set to open in focus on any distance from 2 yards to infinity. This adjustment thus enables one to carry about the camera in readiness for work of any particular kind, say open landscape requiring the focus at infinity, or figures needing it to be at about 3 yards. The camera can be closed however the adjustment for focus is set.

The front is provided with an amount of rise which would be considered good enough for an ordinary tripod camera of the same



Open.

Closed.

size—the lens will rise three-quarters the vertical height of the picture, that is $2\frac{1}{2}$ in., a movement which is perhaps the most valuable a camera of this kind can have, since its very portability will bring it before all descriptions of subject. The finder is of the direct-vision pattern, and is turned up on the lens front in an instant on touching a small lever with the thumb. A collimator pointer on the back of the camera comes into position automatically, and disappears in the same way on the camera being closed. It serves to show the alteration in the view when the front is raised. The shutter of the "Sibyl" is made in the manner familiar to users of N. and G. cameras—that is, entirely of metal—and with pneumatic regulation. The shutter is self-capping, and gives a range of exposures, specially tested and hand-marked, of from half a second to 1-100th second. The plates are carried in single metal slides, in

which each is inserted quickly and fixed in place by spring catches, which will hold a cut film just in the same manner, and keep it flat without the assistance of a carrier. The dark slide is protected from light by a thin metal casing, which encloses it, and is joined to a spring strip, which covers the slit of the shutter after the latter has been removed. The makers thus provide very completely for the proper safeguarding of the plate from light previous to exposure, and this feature of the camera, which is an important one for hand-camera photography, is not advanced without provision of mechanical accessories for rendering that protection absolute. The whole of the metal work of the camera, with the exception of the dark slides, is of magnalium; the slides are of steel, which possesses in the extreme thinness necessary, a degree of rigidity to which the magnalium cannot lay claim. The outside covering of the camera is black morocco leather.

A rapid glance over our specification of the camera's movements will perhaps suggest the thought that neither the latter nor the means taken to obtain them constitutes any novelty in photographic manufacture sufficient to justify a notice of the above length. But that criticism leaves out of account the extraordinarily small bulk to which Messrs. Newman and Guardia have reduced an instrument possessing a list of movements which includes practically all that is required of a camera. That they have achieved this end by a simple method of construction should argue all the more for the popularity of the camera, which, as a matter of fact, is free from complicated mechanism, and has no working parts at all that are not easily accessible. We have never handled a camera which came near the "Sibyl" in the combination of practical efficiency and slim dimensions, and there would seem to be good reason for prophesying a great demand for it as soon as it is ready for the market. The all-important question of price, we understand, will not debar its acquirement. The price of the camera, fitted with an anastigmat lens, working at F/8, will be between £5 and £6.

NEW ALDIS ANASTIGMAT LENSES.

(Made by Aldis Bros., Old Grange Road, Sparkhill, Birmingham.)

An important step has been taken by the makers of the Aldis anastigmats which should enhance these instruments in the eyes of photographers of all classes. Hitherto the great claim of the Aldis has been its simplicity of construction. It is constructed of three pieces of glass, and hence its absence of reflecting surfaces is a guarantee of freedom from ghosts, flare, and other defects incidental to a complex optical system. Moreover, this elementary form of lens is capable of being produced at a price which may give cause for doubt as to its optical perfection. We, however, have satisfied ourselves of the high degree of correction embodied in the complete lens, and that view has been endorsed by others entitled to be heard in such matters. With all these advantages, the "Aldis" has hitherto lacked one feature—and that an important one in the estimation of many photographers. Part of it could not be used as a lens of longer focus, and hence the advantage of great extension possessed by the majority of cameras of the better order was lost.

Now Messrs. Aldis have made good the deficiency by bringing out a supplementary lens which replaces the first component of the anastigmat as at present made, giving a completely corrected lens of double the focal length. The additional power can thus be acquired by every present possessor of one or other of the present series of Aldis anastigmats, viz., II. ($f/6$) and III. ($f/7.7$). For each member of these two series a corresponding front addition will be obtainable, and the total focal length in each case will be double that of the anastigmat as listed. In regard to the optical performance of the newly constructed lens, we have had to go by the first model produced by the makers, the results with which, despite certain minor defects which are to be expected in an instrument incompletely finished, show us that the extra convenience is combined with the optical qualities of the complete lens. By the time these lines appear, the new attachment will be approaching appearance on the market, and it will then be found, we have reason to say, that the aims of the makers will be realised. The new front lens consists of three different glasses, a meniscus, and then behind it, and separated by a small air space, a plano-concave cemented lens of two glasses. Prices are not forthcoming at the time of writing, but will doubtless be obtainable shortly from Messrs. Aldis.

A FOCAL-PLANE CAMERA FOR ROLL-FILM.

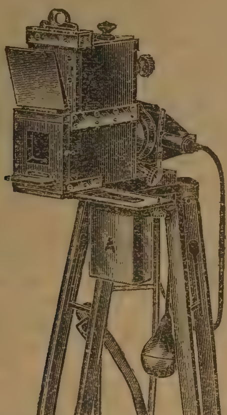
(Sold by the London Stereoscopic and Photographic Co., Limited, 54, Cheapside, London, E.C.)

The construction of the focal-plane camera does not favour its adaptation to a roll-film camera where the sensitive surface remains constantly unprotected; but the difficulty has been overcome very successfully in the Stereoscopic Company's camera by causing the slit of the blind to close before it commences to pass over the plate on being rewound. This adjustment is combined with another. The width of the slit is altered, simply by continuing the action of the winding key, the width being indicated on a scale. On winding the shutter as far as it will go, the slot becomes the full width of the plate and time exposures can then be given. The speeds of the shutter are obtained in the usual way by altering the width of slit and the tension of spring, two tensions being indicated outside the camera, with which, in conjunction with the slit adjustment, the exposures of from 1-35th to 1-2200, given in a table, are to be obtained. The fittings for the cartridges, which, it should be noted, are of the ordinary, not of the roll-holder pattern, are nicely made, with springs to raise the finished spool from its receptacle. The back is also fitted for dark-slides without the necessity of an adapter or any alteration of the fittings. The camera in the quarter-plate size has an extension of 11 inches, and is fitted with cross and rising front of considerable range of movement. These latter are actuated by rack and pinion, admitting of adjustment to a nicety with one hand. The finder is one of the direct-vision type, and there is a sighting rod on the front so that the user gets an idea of the extent to which his picture is altered on the plate when the front is raised or shifted sideways. Fitted with a Goerz Series III. $f/6.8$, the price of the camera, with double plateholders and leather case, is £15.

THE "TAKUQUICK" AUTOMATIC FERROTYPE CAMERA.

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

Of the several automatic ferrotype cameras supplied by Mr. Fallowfield, the No. 16, submitted to us and illustrated here, differs from others in that the development and fixing of the exposed plate are done together in the one solution, presumably by a developer containing hypo such as is given in another section of the "Almanac." The apparatus, which is made in Victoria size only, consists of the upper magazine chamber, containing the supply of plates from which (after focussing the picture in the camera below) they are discharged one at a time. The plate is exposed in the lower, or camera, portion of the apparatus, and is then dropped in the usual way into the



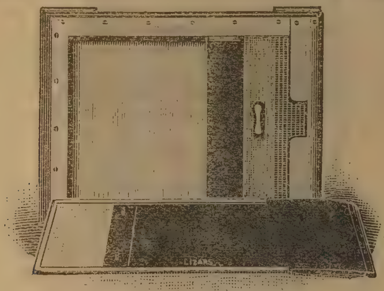
tank A, sufficient time (usually about one minute) being allowed for developing and fixing. The tank A is then moved to one side, and the picture (developed and fixed) can be lifted out in any light, and washed and completed in the usual way. The apparatus is highly finished in polished mahogany, with nickel-plated fittings. The developing tank is nickel-plated, with inner tank of celluloid for solution. Price of camera, complete, £6 6s. Stand extra, from 7s. 6d. to 18s. Combined developing and fixing mixture, in dry form, sufficient to make about 35 oz. of solution, 3s.

THE DAYLIGHT-LOADING SHEATH AND CARRIER.

(Made by J. Lizars, 101-107, Buchanan Street, Glasgow.)

This piece of apparatus is for the daylight loading of cut films or plates, any number of which can be carried in light-tight sheaths (3s. a dozen, quarter-plate size), in leather case. The carrier into which the sheath is inserted for exposure is provided with a flexible shutter

which can cover front or back of the carrier. The shutter being at the front of the carrier, the state of things on the opposite side are as shown in the figure. The flap shutter seen covering the left-hand half of the carrier is raised, the loaded sheath inserted so that two small studs at one end of its flexible cover engage in two holes in the flexible shutter of the carrier. The operation occupies a couple of seconds, and the carrier is then placed in the camera and is ready for exposure.



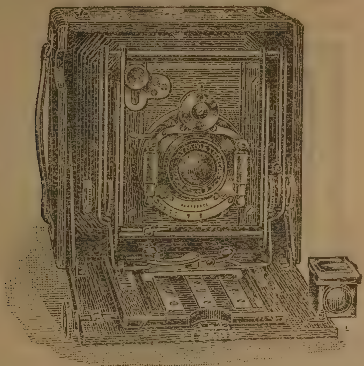
The plate is uncovered to the lens by drawing the flexible shutter from right to left (see figure), the black cover of the sheath which is seen in the foreground of the drawing being thus pulled away and replaced when the shutter of the carrier is pushed home again. We have found the apparatus very certain in use, and the sheaths are strong and rigid. If thought advisable, they can be carried in extra shields obtainable at 6d., 8d., and 1s., in $\frac{1}{4}$, 5 x 4, and $\frac{1}{2}$ plate sizes. The prices of the carrier itself in these sizes are 15s., 18s., and 21s., and it is also made in the $6\frac{3}{4}$ x $3\frac{1}{4}$ stereo size for 20s.

THE "CHALLENGE DE LUXE" CAMERA.

(Made by J. Lizars, 101-107, Buchanan Street, Glasgow.)

The latest model of the Lizars' De Luxe camera embodies the general features of this well-known instrument, but is specially adapted for tropical use, as the joints have all brass tongues to them and are securely fastened by means of screws. The wood of which these cameras are made is teak, and the instruments are usually supplied with a polished surface, though they can be had leather covered when desired. The bellows is of Russian leather, and the whole finish of the very first quality, the aim of the maker being evidently to produce as well-made a camera as it is possible to procure. We cannot give a better notion of the potential performance of the camera than by quoting the makers' specification, though that, unfortunately, does not convey an idea of the excellent finish of the wood and metal work:—Camera.—Reversing back camera. Diagonal rack and pinion focussing movement. Bellows with great latitude of adjustment in conjunction with the swing front. Shutter.—This is the well-known Bausch and Lomb "Unicum." Lenses.—All the lenses are carefully tested before being sent out. Slides.—Three book-form double dark

slides, having rabbetted frames and shutters, and tongued in well. Finder.—The improved brilliant form, giving approximately the same view as that shown by the lens. Level.—A spirit level is attached to the baseboard close to the finder. Special features.—The lens, shutter, and finder, all close up within the camera, and with focussing screen and hood, combine in one; independent lens panel rising and falling



front; camera can be instantly opened, and securely fixed at any position by means of quick-acting lever; automatic lock, which securely fixes the front at infinity distance, and graduated lens scale. The price of the De Luxe in quarter-plate size, with "Challenge Beck" symmetrical lens, is £7 10s., or it can be supplied with anastigmats by leading makers at prices from £8 8s. to £12 10s.

THE "IMPERIAL" TELESCOPIC PORTABLE SCREEN ELEVATOR.

(Made by R. R. Beard, 16, Trafalgar Road, Old Kent Road, London, S.E.)

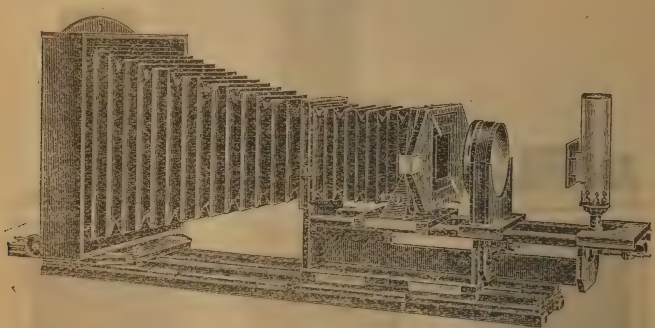
In this apparatus Mr. R. R. Beard applies his own resources and those of his factory to the solution of a problem which has doubtless confronted hundreds of lantern operators, himself included, viz., the hanging of the lantern screen in public halls and buildings. The elevator consists of a series of light standards of steel tube, each provided with a clamping ring and thumb screw. The top and bottom poles are of pine, fitted with steel ferrules, but all the other elements of the frame are of light steel tube. The body and lid of the case in which the tubes are packed form the feet for the stand, and the whole outfit (screen included) in its travelling state thus occupies a space of only 5 ft. x 7 in. square. This is for a 20 ft. screen, in which size the total cost of the frame is £9 9s. for polished nickelled standards and ferrules, £8 8s. if dull nickelled, and £8 if plain. The elevator is supplied of any size up to 30 ft., 12, 16, and 20 being, however, the standard listed sizes. The mounted screen can be strained perfectly flat on a frame of this kind, and the

"Imperial" apparatus should prove invaluable to the lantern and cinematograph operator, no less than to the home exhibitor; for the latter can raise his screen to the extreme height of the room, and thus obtain the maximum size of disc.

THE "N AND G" ENLARGING CAMERA.

(Made and sold by Newman & Guardia, 90 & 92, Shaftesbury Avenue, London, W.)

The present apparatus is a modification of that introduced some years ago by Messrs. Newman and Guardia. It has now been adapted to the "N and G" system of interchangeable parts, so that the apparatus is suited for use in daylight and equally with any form of artificial light. The whole construction is solid in the extreme, and such as to ensure the absolute parallelism of the negative and the screen, or sensitive paper. This rigidity of build has the further advantage of permitting the apparatus to be tilted to any angle without disturbing the relations of the parts. We cannot do better than quote the maker's technical specification, which a close examination of the camera allows us to confirm in the various particulars:—



Triple adjustments for regulating the degree of enlargement or reduction, with clamping nuts to fix the parts in any position. Rack and pinion focussing. Square negative holder, detachable from the camera, centres automatically any part of the negative, and provides adjustments for correcting lines out of the perpendicular in vertical or horizontal pictures. Any lens, from $\frac{1}{4}$ to $\frac{1}{2}$-plate size can be used. Flap shutter, actuated from outside and working without vibration. "Solid" dark slide of special construction ensuring great strength; the shutter pulls right out and the back is detachable. Plate glass and backing-board for holding bromide paper of any size absolutely flat and in any position. Ground-glass screen in strong quick-changing frame. Reversing back, rigid base-board, built on "N. and G." standard system, allowing the parts to be instantly fixed in any position. The prices of the apparatus complete for enlarging from $\frac{1}{2}$-plate to 15 by 12 in., including one slide, focussing screen, and two extra

carriers (without lens), £13 10s.; Zeiss Ser. IIb., No. 4 "Tessar" lens, *f*/6.3, £4 15s.; ¼- plate attachment for artificial light, including 5½ in. condenser, lamp for paraffin, or incandescent alcohol, or electric (Nernst) light, and detachable baseboard extension, £4 4s.

THE "RAJAR" FILM SLIDE.

(Made and sold by Rajar, Limited, Mobberly, Cheshire.)

This piece of apparatus embodies a new system of daylight loading and changing for cut films. The changer itself is light and compact,

Fig. 1.

being constructed of wood and no larger than an ordinary double dark-slide. It is made in the size to fit ordinary popular patterns of camera, and can be sent out ready for use on naming the camera,

Fig. 2

Fig. 3.

Fig. 4.

or supplied with its edges ungrooved so that any cabinet-maker can cut the groove for a trifling sum. The film slide is loaded in daylight with separate cut films, which, after exposure, are collected up to the number of about a dozen in the film slide. Each film is supplied in a light-tight envelope, which is inserted in the slide. Here it encloses the film, as shown in Fig. 1, the tag projecting from the top of the slide. On pulling the tag a short distance, the loop or "cap" is drawn behind the envelope and the film is caught on its two extreme corners by two steel wire springs. The figures show the stages in the changing of the slide:—Fig. 2, film envelope inserted in front of

shutter by passing through valve between the shutter and the body of the slide. Fig. 3, tag raised as far as it will come, to draw the "cap" behind the envelope. Fig. 4, envelope pushed back into the slide in front of "cap," and film caught by wire hooks. The envelope and cap are now pulled right out of the film slide, and the film is left ready for exposure, as shown in Fig. 5; the shutter of the slide in this and other drawings being shown removed to disclose the stages of the process. After exposure, the film is transferred to the back part of the slide simply by withdrawing a shutter. The price of the slide is 10s. 6d. in the quarter-plate size, and films of the same size, special rapid or ordinary, are 2s. per dozen. The apparatus weighs only a

Fig. 5.

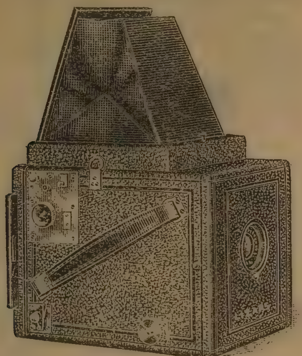
few ounces, and is absolutely free from mechanism. The manipulation of the envelopes is easily understood, and the new system should appeal strongly to the amateur tourist photographer, who fights shy of dark rooms, but yet wishes to carry with him the means of making an unlimited number of exposures. The lightness and flatness of the Rajar envelope packages are two great points in their favour.

THE CHALLENGE "REFLEX" CAMERA.

(Made by J. Lizars, 101-107, Buchanan Street, Glasgow.)

The Challenge "Reflex" is a camera of the well-known reflector principle, complete with lens at a price of £7 10s. in the quarter-plate size. For this figure an instrument with a number of adjustments is supplied. The camera is of the single extension pattern, and will take lenses of not less than 6 inches focal length. The lens front has rising and cross movement, and is actuated by rack and pinion for focussing; the mirror providing the full-sized image up to the moment of exposure is specially prepared against tarnishing. It works in conjunction with a "Challenge" focal plane shutter, adjusted in all its movements from the outside of the camera, and permitting time exposures as well as the shortest instantaneous times from 1-10th to 1-1000 of a second. The focussing screen on the top of the camera is shielded by a self-rising hood 8 inches in height, which effectually facilitates the examination of the picture on the ground glass. A second focussing screen is provided at the back of the camera for use in the usual way. Both back of camera and the screen above the mirror are made square, and the former is fitted with a reversing back

for horizontal or vertical pictures in the one position of the camera. A form of the camera without this valuable movement is supplied at a lower price, and with the other point in its favour that a lens of shorter focus, 5 inches in the quarter-plate size, can be used on it. The whole apparatus evinces care and thoroughness in its design, and as we have said, is offered at the price of £7 10s. inclusive of three double slides. With slides, inclusive of fitting the buyer's own lens,



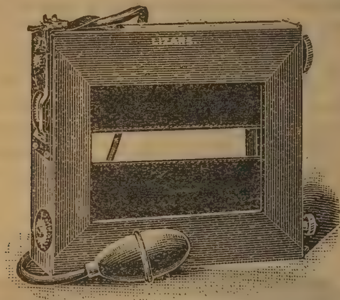
the price is £6 10s. With other lenses as follows:—Aldis lens, Series II., *f*/6, £9 11s. 6d.; Taylor, Taylor and Hobson lens, £8 10s.; Ross Rapid Hand Camera Lens, £8 10s.; Ross Homocentric Lens, Series C, *f*/6.3, £11; Taylor and Hobson "Cooke" Lens, Series III, *f*/6.5, £12; Goerz Double Anastigmatic Lens, Series III., *f*/6.8, £12 15s.; Dallmeyer Stigmatic Lens, *f*/6, £13 5s.

THE "CHALLENGE" FOCAL-PLANE SHUTTER.

(Made by J. Lizars, 101-107, Buchanan Street, Glasgow.)

As submitted to us in the quarter-plate size, this focal-plane shutter measures outside $5\frac{1}{2}$ x $5\frac{1}{4}$ x $1\frac{1}{4}$ inches, and is so made that a dark-slide or changing box can be fitted, the shutter itself being adaptable to any squarely-built camera. All the adjustments are made outside, that of the width of slit consisting in the depression of a knob on one side of the shutter when the winding key on the other controls the width of the slit. This alteration can be made at any position of the blind in the daylight opening, and the separation of the two parts of the blind can be increased until the full plate is uncovered. In the time-exposure position the shutter is set for giving exposures as long as may be wanted by turning a button on the top. Thus used, its lightness of running and freedom from vibration should stand the user in good stead, for it is probably within the experience of practical workers that the jar of some focal-plane shutters in opening to the full aperture is enough to destroy fine definition. For instantaneous work the conjunctions of tensions marked 0 to 9 outside

the shutter, with one or other of the five scaled openings in the blind permits of times from 1-10th to 1-1000 of a second. There is pneumatic and finger release, and the workmanship of the shutter in all

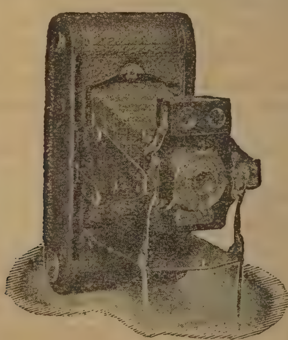


respects impresses us as of the best. The price in quarter-plate size is £2, and a charge of 5s. to 10s. is made for fitting to a camera according to the work required.

A NEW MODEL 1A FOLDING POCKET KODAK.

(Made by Kodak, Limited, 57 61, Clerkenwell Road, London, E.C.)

This introduction of the Kodak Company is an improvement on the earlier form of the popular little camera known as the 1a F.P.K. The working parts are entirely enclosed by the folding base board, and this base, which now protects the hitherto exposed lens and shutter, is so connected with the front that the action of opening the camera instantly brings the front into the correct position for



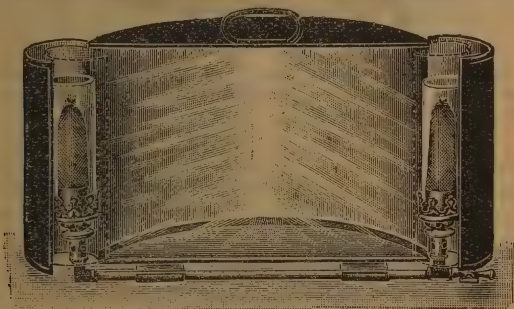
work. Only this one operation is necessary, therefore the camera can be said to be always ready for immediate use. From its design the camera is necessarily of fixed focus, and the lens, which is

capable of giving excellent definition at full aperture, is neatly mounted in an ever-set shutter. The camera takes pictures measuring $4\frac{1}{4}$ by $2\frac{1}{2}$ in., and, being constructed on the daylight loading and changing principle, can be charged with spools for twelve or any less number of exposures. The price is 50s.

THE "PARABOLOID" ENLARGING LAMP.

(Made by Lancaster and Son, Limited, Birmingham.)

The success of this well-known paraboloid single lamp for enlarging purposes made by this firm has induced them to put on the market an improved model which will be welcomed by the enlarger and copier, inasmuch as it gives double the quantity of light. Instead of the source of light being fixed at one end of the parabola, as in the previous pattern, the curve of the metal back has been altered and a light



can now be contained in convenient shelters at both ends of the curve. The result is that an intensely white light is reflected from the matt white back of the interior of the apparatus, and the illumination is distributed evenly over the entire surface of the plate to be enlarged. In the new form it is fitted to burn incandescent gas and costs, with two burners, and complete, in whole plate size, 10s. 6d.

THE "SINNOX" DAYLIGHT-LOADING CAMERA FOR GLASS PLATES.

(Sold by Marion & Co., 23, Soho Square, London, W.)

A system of transferring the purchased box of plates directly into the camera for exposure may be reasonably sure of a warm welcome from a large class of amateur workers. Old hands may not regard the dark-room in the light in which our young friends—young in photography, if not in years—look at it, as the bugbear of an otherwise delightful recreation. The fact remains that "without a dark-room" is a phrase to conjure with, and Messrs. Marion can therefore claim attention for the system under which the photographer thrusts the box of plates into his camera as he leaves the dealer's shop, and is straightway ready for his exposures.

The "Sinnox" camera achieves this in a very simple way. Each plate is supplied in a cover of black paper, and when the packet of half a dozen is placed in position in the camera (fig. 1) it is only

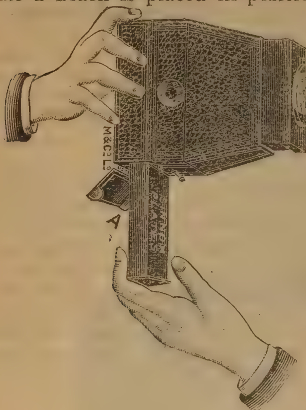


Fig. 1.

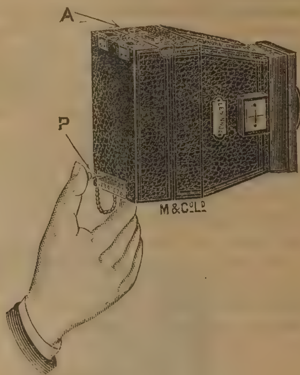


Fig. 2.

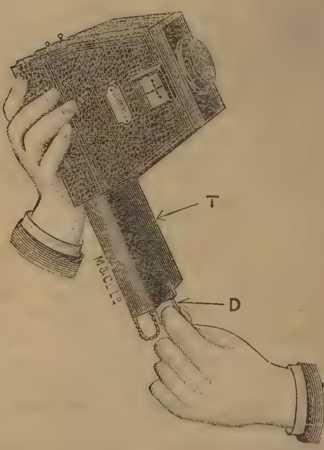


Fig. 3.

necessary to insert a pin into the first of six holes (fig. 2) and to draw off the outer case of the packet under cover of the chamber marked T (fig. 3). Plate No. 1 is then ready for exposure, and in the same way, inserting the pin in holes 2 to 6, the remaining five plates are ex-

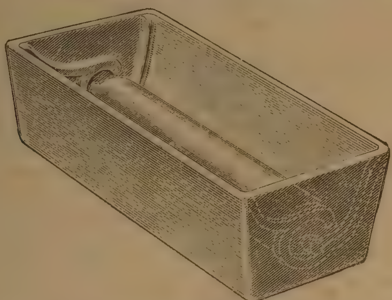
posed. The packet is now removed, and can be sent off for development or developed like any other plate—in a dark-room.

The changing device, in our experience of it, has proved most reliable, and, altogether apart from daylight-loading, seems to possess the elements of regular working. The cameras at present embodying the "Sinnox" system are four in number, two for plates 3½ by 2½, and two for quarters. The prices range from 31s. 6d. to 60s., whilst plates of H. and D. 200 cost 1s. per half dozen in the quarter-plate size. The "Sinnox" price-list fully specifies the cameras, and is obtainable from Messrs. Marion.

THE "ECONOMIC" DISH.

(Made by Houghtons, Limited, 88-89, High Holborn, London, W.C.)

This dish is intended for use when developing roll films, and for this purpose it seems to amply fulfil all that is claimed for it. It is made of porcelain, and, as will be seen from the illustration, is a deep dish, with a porcelain roller, held in sockets made in the inner sides. The roll films are slipped under this roller and passed to and fro during development, this motion being consider-



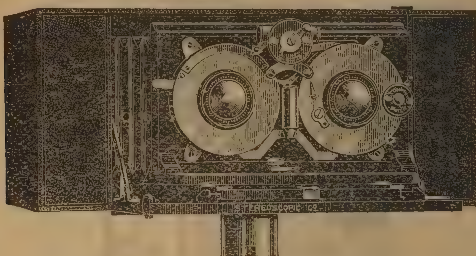
ably helped by the free revolution of the roller. Not the least attractive point in favour of this useful dark room adjunct is the small quantity of developer necessary for use, as only sufficient to submerge the under side of the roller need be used. To take films up to 4 inches wide the price is 3s. each; to 5½ inches 3s. 6d.; to 7½ inches, 4s. 6d.

A STEREO-PANORAMIC CAMERA FOR PLATES AND ROLL-FILM.

(Sold by the London Stereoscopic and Photographic Company, 106-108, Regent Street, London, W.)

The size of picture taken in this camera is 6½ x 3¼ in., and the adjustments permit of a pair of stereoscopic negatives or a single panoramic picture being obtained on both plates and roll-film. One of the pair of lenses used for the stereoscopic exposures is employed

for the panoramic negative, and hence the optical performance of the lenses must be of the best. The camera is fitted with a pair of 6 in. Goerz "Dagors," Series III., $f/6.8$. That used for the panoram can be placed centrally or raised considerably over the centre of the plate, a movement which must necessarily be often



required when photographing tall objects on the upright plate. There is also a rise of over half an inch when working the long way of the plate. The camera carries a pair of "compound" diaphragm shutters, everset for "time" and "bulb" exposures, and scaled for instantaneous work from 1 to 1-100th second. The film chambers are those for ordinary (not roll-holder) cartridges, and the dark slides, which are of the solid pattern, but non-draw-out shutters, fit the camera without an adapter. The whole construction is handsome and substantal in every detail. With three double slides the price of the camera is £26 15s. ; without the slides, £24.

THE "ROYAL" TIME AND INSTANTANEOUS SHUTTER.

(Made by the Thornton-Pickard Manufacturing Company, Limited, Altrincham

The chief point of interest attached to this shutter is that all working parts are fitted inside the box. Apart from this it is as reliable and efficient as the standard T. and I. pattern, which it resembles in other respects. In the new and improved pattern there appears to be nothing to get out of order, as all fittings are enclosed. The outside dimensions are $3\frac{3}{8}$ by $2\frac{1}{2}$ by $\frac{7}{8}$ thick including all projections. By simply sliding a small knob it is possible in the new pattern to alter the shutter from "Inst." to "Time." The driving spring is at the same time and by the same movement reduced to its lowest tension suitable for a time exposure. It is, moreover, impossible, while the shutter is thus set, to again increase the tension, unless the knob is put back for an instantaneous exposure. The wear and tear of the working parts of the shutter are therefore reduced to a minimum. Repairs will consequently be seldom necessary and the life of the shutter will be indefinitely prolonged. The working of shutters of this type for "Time" exposures with the driving spring at high tension has hitherto been the most fruitful cause of damage, but now that it is automatically prevented it will

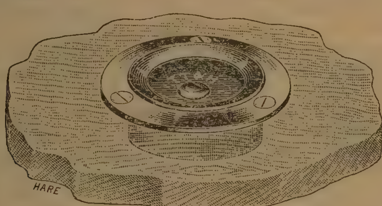
be obvious that a great improvement has been effected in the construction of roller blind shutters. This simple and ingenious patented device serves as a tension release and also as a shift lever (altering from Inst. to Time and vice versa) and for releasing the shutter

with the finger independent of the pneumatic release. The time value can, of course, be fitted and exposures from 3sec. to 1-90sec. can therefore be given as with the standard pattern. The prices are from 17s., including speed indicator.

"FLUSH" LEVELS.

(Made by Taylor, Taylor, and Hobson, Limited, Leicester.)

Messrs. Taylor, Taylor, and Hobson's spirit levels are already extremely well-known as being well made and reliable for the purpose for which they are intended, and the photographer whose camera is fitted with one of these little instruments can always rely thoroughly

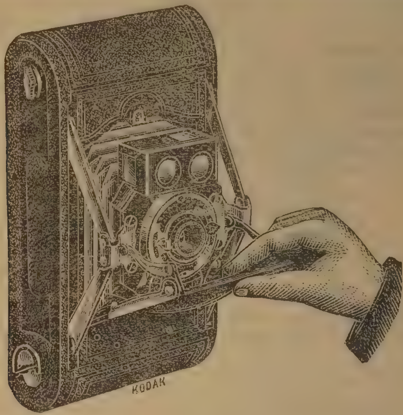


upon it. They are now being supplied in such a form that they can be sunk into the woodwork of the camera, so that the surface is perfectly flush with the camera body. The efficiency of the level is in no way impaired, but the neat appearance of the camera is considerably enhanced

THE NO. 1 FOLDING POCKET KODAK (NEW MODEL).

(Made by Kodak, Limited, 57-61, Clerkenwell Road, London, E.C.)

In the latest pattern of the well-known No. 1 F.P.K., the Kodak Co. have modified the design in certain important particulars. The working parts are now enclosed by a folding baseboard, so that all mechanism is protected from dust and wet. This safeguard does not entail another operation, for, by a most ingenious device, the lens



front is drawn into its proper position by the simple act of drawing down the base-board. There are other improvements, but this one of the automatic moving front is the only one which the dealer need demonstrate when exhibiting the camera to a customer. It exerts a subtle "there-you-are-Madam" kind of influence, which, if we are not mistaken, will be irresistible. The price remains the same—£2 2s.

THE "SWINGCAM" CAMERA STAND.

(Invented and sold by William Butler, 20, Crosby Road, Birkdale, Southport).

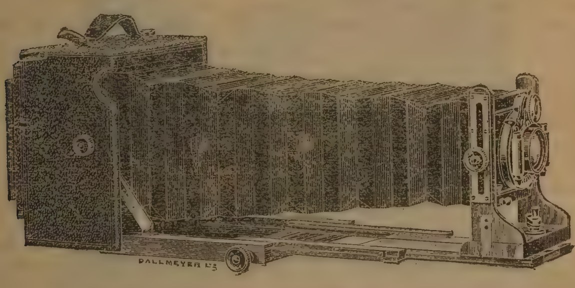
Every conceivable position for the camera wherever it may be necessary to plant the tripod—that is what the inventor of the "Swingcam" stand offers to achieve. The construction on which the stand relies to carry this promise into execution is a comparatively simple one. Each leg of the tripod is connected to the head by an attachment which is doubly jointed, and also is free to turn at its point of junction with the head. As a result, the tripod acquires a mobility of its parts which permits of the most extreme positions being taken by the camera. The stand being fixed in its normal position, it is the work of a second or two to adjust matters so that the camera points vertically downwards; or just as expeditiously it can be pointed upwards. Any inclinations between these

limits are obtainable and the jointed attachment of each leg enables the tilt to be altered without disturbing the position of the feet. In short, the tripod has a greater range of movement than a ball-and-socket head, without the weakness which, by its construction, the ball-head possesses. In the most exceptional positions it is highly stable and rigid, a fact which we attribute to the mechanical strength, yet simplicity, of the jointed attachments. A photographer need not be occupied with the very special work of natural history, surveying, or similar photography—for which the maker specially offers the tripod—in order to prove the value of its great range of movement. To take two positions, in which it is often advisable to place a camera:—right in a corner of a room or flat against a wall. With an ordinary tripod it is impossible to do so without sacrificing rigidity, but with the "Swingcam" these particular movements are made at once, and the camera is placed with all necessary stability. Moreover, when thus placed, it can be tilted up and down through a large angle. We venture to say that anybody who has to do photography in confined quarters will appreciate this feature of the tripod. There are some other technical points we might refer to, such as the attachment which keeps the points of the legs vertical however much the legs are spread out, but a booklet issued by the inventor sets forth these and other details by aid of a number of illustrations. The normal height of the tripod is 4 ft. 9 in.; with extension bars, 7ft. 3 in. The price of the "Swingcam" is £3 3s.; if with extension bars, £1 1s. extra.

THE TRIPLE EXTENSION CORRESPONDENTS' CAMERA.

(Made by J. H. Dallmeyer, Ltd., 25, Newman Street, Oxford Street, London, W.)

This well-known camera, for which the makers may justly claim a high degree of portability without sacrifice of the most substantial build, is now made of triple extension pattern, fitting it for telephoto

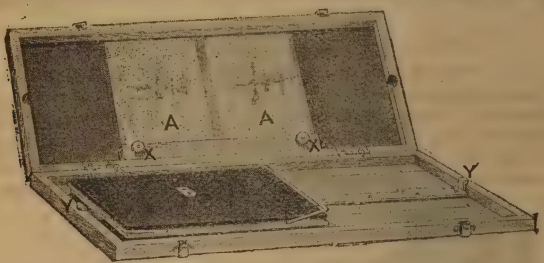


and other special work. In the quarter-plate size submitted to us the extension is 15½ in., the 5 x 4 and half-plate cameras having proportional lengths of draw. The price of the camera remains the same, £15 15s. 6d., in quarter-plate size, with three double slides.

THE "BROWNIE" STEREO-PRINTING FRAME.

(Made by Kodak, Limited, 57-61, Clerkenwell Road, London, E.C.)

With this compact printing frame negatives on glass or film can be printed on to a single piece of paper, and when finished can be mounted for the stereoscope without transposition. In use the frame

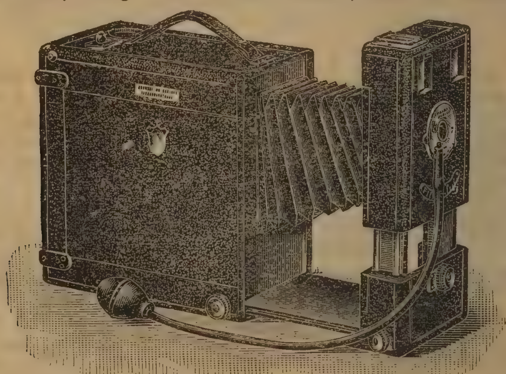


is very simple and rapid, and is strongly, yet lightly made. The prints are obtained with a narrow white margin, and with the pictures level and at the right distance apart. We conceive that users of the Brownie stereos will find the frame an indispensable adjunct to their outfit.

THE "PANOKAM."

(Made by Lancaster and Son, Limited, Birmingham.)

A well-made box-form camera, with a reliable focussing arrangement and scale, rising front, brilliant finders, time and instantaneous



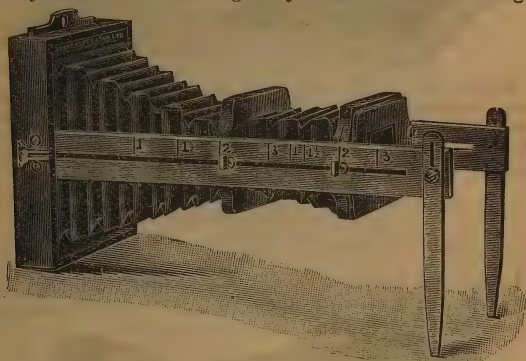
shutter, magazine for twelve plates, an ingenious changing device and a good lens, and magnifiers are among the attractions offered by

Messrs. Lancaster for the low price of 25s. The focussing arrangement is sound in principle and efficient in use. The whole front of the camera containing the optical parts and shutter racks away from the body containing the magazine, and the rising front can be used at any focus. The apparatus can be had with R.R. lens at 31s., or with casket combination Rectigraph at 52s. 6d. It is excellent value.

THE "MAGNIGRAPH" ENLARGER.

(Made by Lancaster and Son, Limited, Birmingham.)

The Magnigraph is a new enlarger of simple construction, but at the same time ingenious and is certain in action. It is made with the enlarging scale marked on side runners, giving amount of enlargement at specified distances. The height of the front of the enlarger can be adjusted to face the light by means of movable legs. The



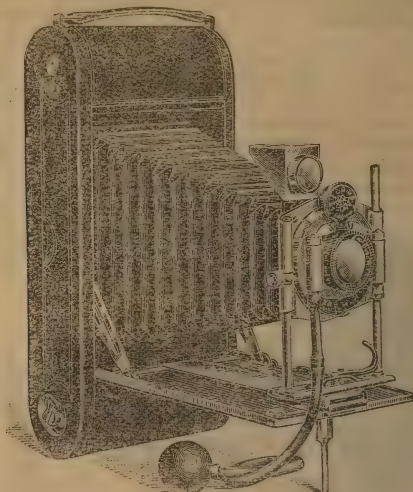
carrier is adjustable and an excellent lens with exposing shutter is supplied with the outfit. The entire apparatus folds into a remarkably small compass and can be thus easily carried. When extended the enlarger is perfectly rigid and reliable. The price for the 10 by 8 size is 30s., for 20 by 18, 90s. Intermediate sizes are supplied at proportionate rates.

THE "ALBUM POSTCARD," "CYCAM," AND "ROYAL BEECAM" CAMERAS.

(Sold by the Emil Busch Optical Company, 35, Charles Street, Hatton Garden, London, E.C.)

From a large series of cameras of the folding pattern, and adapted for both plates and roll films, we select these three of the Busch Optical Company's, as they appear embodiments of the slightly different types of which popular taste has signified its approval. Differing in size and in details of fittings, they conform in the main to that order of instrument which is suitable for use on hand or stand, and which has the distinguishing advantage of being

got ready for action in a moment, and of as quickly resuming its character of an inconspicuous black case carried in the hand without inconvenience. The "Album Postcard," for the postcard size of



$3\frac{1}{4}$ x 5, and requiring a $3\frac{3}{4}$ cartridge, is fitted with a 7 in. Busch detective aplanat, working at *f*/7, and a diaphragm shutter, with the usual instantaneous bulb and time adjustments. As the shape of the

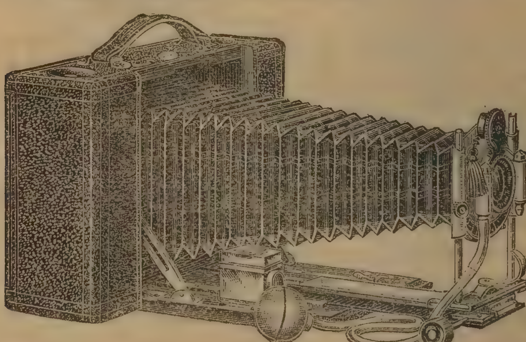
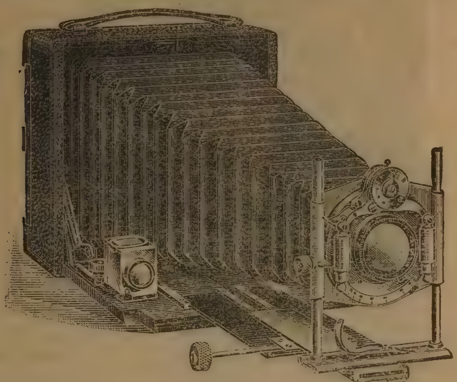


plate requires, there is considerable rise of front, in addition to cross movement. The back accommodates plate holders and focussing screen, so that the camera is available for more serious work on

a tripod, with a focussing screen, in the intervals of snap-shotting on roll film. The double infinity catch and focussing scale permit of snap-shot work on plates if so desired. The price of the camera is £5 12s. 6d. With Busch "Omnar" Series II., *f*/5.5, £8 10s. 6d.

The "Cycam" is a smaller build of camera, for both plates and films, but is made in the standard sizes. It has a long bellows extension, 11 inches in the 5 x 4 size, submitted to us, so that copying and other indoor work are within its power. The lens is the Busch "Omnar" Anastigmat, Series III., *f*/7.7, of 6 inches focus, with which the price of the 5 x 4 camera is £8 2s. 6d.; with Busch Detective Aplanat, *f*/6.5, £6 10s.



The "Royal Beccam" is a plate camera of long extension, with a swing back, in addition to the movements enumerated in reference to the preceding cameras. The single plate holder is clamped firmly in its grooves, and while *in situ* the shutter of the slide is automatically prevented from drawing out completely, with the result that its return to the slide is rendered certain. Complete with Busch R.R., *f*/8.6, three single slides, with leather case for the latter, and the whole outfit, the price in 5 x 4 size is £5 5s.; with Busch Detective Aplanat, *f*/6.5, £6 5s.; and with Busch "Omnar" Anastigmat, *f*/5.5, £8 17s. 6d.

THE "VIVID" FLASH LAMP.

(Made by Houghtons, Limited, 88-89, High Holborn, London, W.C.)

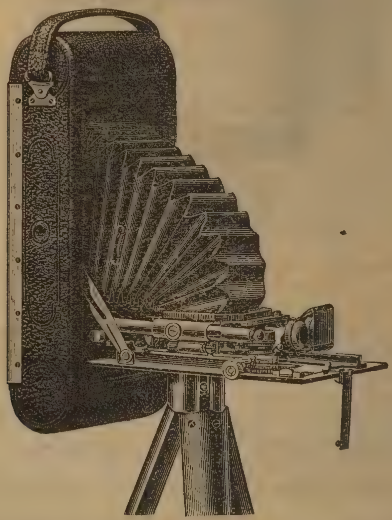
This useful little piece of apparatus will commend itself at once to the aspirant to flashlight photography by its simplicity. It is strongly made of metal throughout, and is heavily plated. A reservoir is in the middle, to contain a charge of flash powder, and a broad flame is generated round the opening of the reservoir by

burning asbestos soaked in spirit. This part is well protected by a perforated screen. The flash is actuated by a pneumatic ball and for home use no better flash lamp of small size can be desired. It sells at 5s.

ROLL FILM AND PLATE CAMERAS, WITH ROSS LENSES.

(Sold by Ross, Limited, Clapham Common, London, S.W.)

Messrs. Ross, Ltd., are now supplying several patterns of portable folding cameras, adapted for both roll film and the ordinary cartridges, and plates and dark slides. The model shown in the figure is made in quarter-plate and postcard ($5\frac{1}{2}$ x $3\frac{1}{4}$) sizes, and has several points of novelty additional to the many popular features of this type of camera. The postcard camera has double extension, racking out to $11\frac{1}{2}$ inches, but the sliding base is fitted with a gear wheel and clamp, so that the lens front can be pulled out quickly to any point, and on the clamping screw being given a turn, the rack

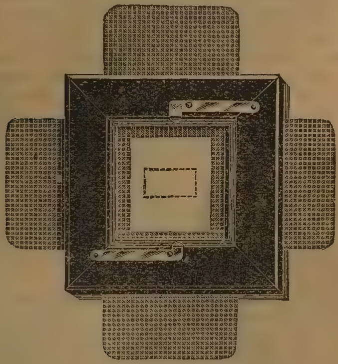


is brought into action for fine focussing. There is a screw cross and rising movement of the front, and the whole front also is hinged, with the result that the camera folds up into the body without removal from the guides. Finder, level, and "Unicum" or "Automat" shutter are fitted in the usual way, and the cameras are supplied with the Ross "Homocentric," Series C., $f/6.3$. Prices in quarter-plate size (single extension), £7 15s.; double extension, £9 10s.; postcard size, $5\frac{1}{2}$ x $3\frac{1}{4}$, £10 15s. These prices include focussing screen and three dark slides, in leather wallet.

THE "PRIMUS" LANTERN SLIDE GAUGE.

(Made by W. Butcher and Sons, Farringdon Avenue, E.C.)

This useful little piece of apparatus will undoubtedly fill a want, and by those lantern slide makers who wish to make the most of their pictures and not be bound down to conventional cut sizes in masks it will be greatly appreciated. It enables the best size opening to be found to suit any slide, and the moving parts are adjusted with the greatest ease. The slide to be masked is placed in the frame, film



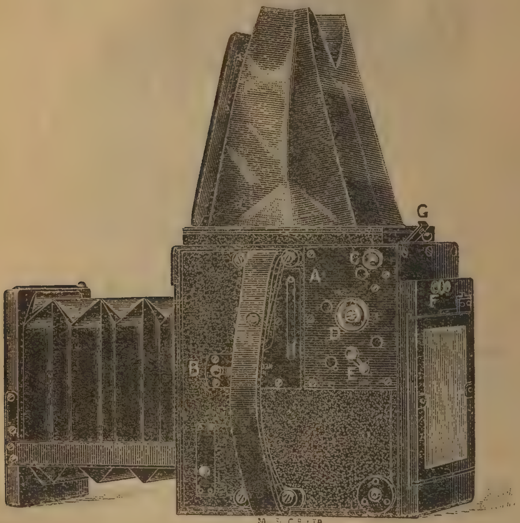
down, and is then fixed in position by two springs. The four sliding shutters are then adjusted until the desired opening is found. The mask can then either be built up with strips of opaque paper or the desired openings can be cut in squares of black paper which are supplied for the purpose. The price of the gauge and a packet of masks is 1s. 6d.

THE "SOHO" REFLEX CAMERA.

(S ld by Marion & Company, Limited, 22-23, Soho Square, London, W.)

The notable feature in this new pattern of reflector camera is, first of all, the arrangement of the mirror by which a more compact construction can be adopted. Without some special means to avoid the difficulty, a lens of about 6 in. focus is as short as can be used when the reflector principle is employed: a shorter one does not leave space enough for the mirror to pass. In the present model the mirror is mounted on an ingenious system of frames, so that in its passage from the inclined position to a horizontal one at the top

of the camera it recedes away from the lens, dodging it, so to speak, and demanding a smaller space for its movement. This "doubling" motion, as we have said, permits a shorter focus of lens, and reduces, of course, the length of the camera, which in the quarter-plate specimen before us is 6½ in. from plate glass to lens front. In other respects the camera is well equipped. It carries a Kershaw focal plane shutter, working, at one tension only, from 1-16 to 1-800 of a second, and with outside adjustments for alteration of width of slit, up to the full-plate width for time exposures. The extension from lens front to plate is 10½ in., sufficient for the use of a single component of the lens on taking advantage of the slight extra extension provided by reversing the recessed mount of the complete lens.

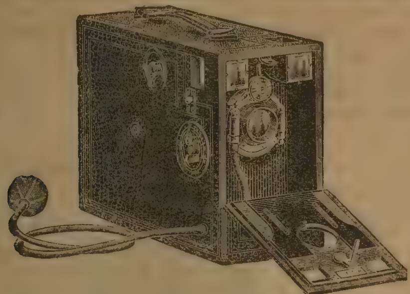


There is a considerable rise and cross movement of the front, and altogether the camera answers the most varied demands of the photographer who purchases it, first of all, for the boon of actually focussing his picture. The price of the camera, with three double slides but no lens, is £12 in quarter-plate size; with Dallmeyer Stigmatic II. $f/6.3$, £17 5s.; with Ross "Homocentric" C $f/6.3$, £16 5s.

THE FAIRFIELD No. 17 HAND CAMERA.

(Sold by Hora & Co., 346, York Road, Wandsworth, London, S.W.)

In this box camera, the 12 plates or cut films are carried in sheaths, and changed by a mechanism which we have found certain in action. The disc focussing scale is bold, engraved from 6ft. to 10ft., and for convenience in use is one of the best forms with which

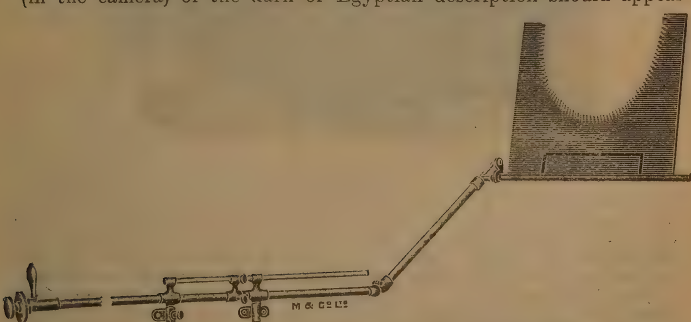


we are acquainted. The lens is an R.R., working at $f/8$, and is fitted with the well known Bausch and Lomb "Unicum" shutter, the setting of which, as well as the release, is done from the outside of the camera. The actuating lever is seen on the inside of the door in the figure. Complete, with two finders and bushes for tripod, and covered in hard leather cloth, the price of the camera is £1 17s. 6d.

A NEW STUDIO VIGNETTER.

(Sold by Marion & Co., Limited, 22 23, Soho Square, London, W.)

This piece of apparatus for the production of vignetted negatives (in the camera) of the dark or Egyptian description should appeal



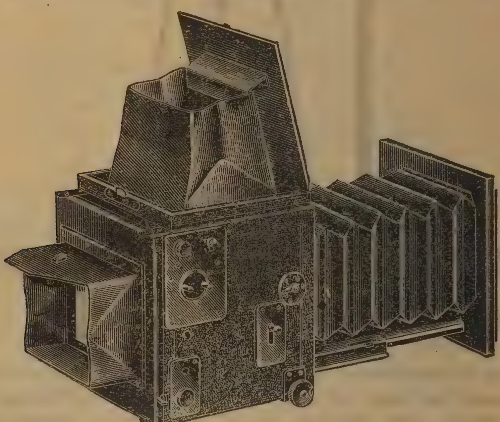
to the operator from the fact that all the adjustments are made from one point, and that situated at the side of the camera. The

vignetting card can be moved to and fro and up and down and can be tilted at any angle, all these adjustments being made by the lever and knob at the end of the supporting rod. This latter is supplied mounted on hard wood for attachment to the camera, and the whole apparatus is instantly removable by lifting it out of the two sockets. Price, 32s.

THE "PLANEX" REFLEX FOCAL PLANE CAMERA No. 2.

(Sold by the City Sale and Exchange, 90-94, Fleet Street, E.C.)

The popularity of the reflex type of camera seems still further on the increase this season. The "Planex' should certainly hold its own therefore, if points of compactness and cheapness are considered. The quarter-plate which was submitted for our review gives an extension of 12½ in. It is fitted with reversing back and rising and cross fronts. One or two little points of its construction appear to have had considerable thought expended upon them. For instance, the pinion is fitted with an extra milled head by the aid of which the focus is locked at any given point with ease and certainty. The focal plane shutter, which gives



any exposure from 1-10th to 1-1,000th part of a second, as well as time exposures, is fully adjusted from the outside, and this may be done with the slide in place ready for exposure. The release is effected by the raising of the mirror, and the whole works very smoothly and silently without vibration. The movement of two levers sets the shutter and mirror to time. The size of the camera is 7 in. by 7 in. by 6 in., and it is finished in black lacquering and leather. The price is from £5, and any suitable lens may be fitted. Either dark slides, changing box, or daylight roll holder may be used, and all are interchangeable.

A WALKING STICK TRIPOD.

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

The figure shows the appearance of the stand when opened and closed. As carried the tripod forms a convenient walking-stick, and it is only necessary to remove the handle and pointed ferule and draw

out the extension of each leg to have a very rigid tripod of the standard height. The price of this very light and portable tripod is only 9s.

THE "ROTATOR" HAND CAMERA.

(Made by the Thornton-Pickard Manufacturing Company, Limited, Altrincham.)

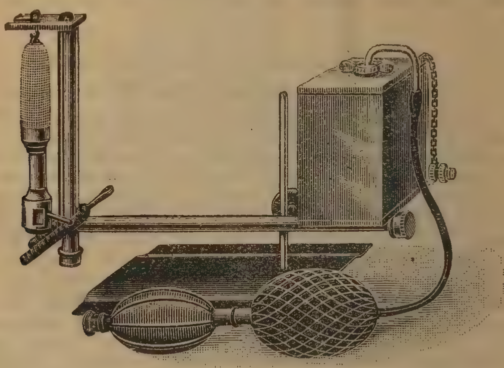
This camera has been introduced by the Thornton-Pickard Company to supply the demand for a cheap hand camera of the magazine type with perfectly efficient roller blind shutter. It is made in ¼-plate and post-card sizes, and is a thoroughly reliable instrument. It is well made of mahogany, covered with black seal-grained leatherette, and is of neat appearance. A hinged front door gives access to the lens, etc., and a special focussing arrangement has been fitted. One of the well-known T.P. "Time and Inst." shutters is adapted for use behind the lens, and this is fitted with a new patent self-capping arrangement in the form of an internal safety cover to protect the plate from light while setting the shutter. Two brilliant view-finders are included, and the changing mechanism is an

ingenious device of simple construction that is sure in action. By sliding a metal push on top of the camera a plate is changed and the number of the next plate (which is then ready for exposure) is automatically registered on a rotating numerator. The door at back of camera permits of the exposed plates being removed without interfering with the unexposed. The price of the camera with a good quality single achromatic lens with iris diaphragm, is 30s.; or 40s. post card size ($5\frac{1}{2}$ by $3\frac{1}{2}$), but any lens can be fitted at proportionately increased cost.

THE "META" HIGH PRESSURE SPIRIT LAMP.

(Sold by W. Butcher & Sons, Farringdon Avenue, London, E.C.)

The popularity of lamps in which an ordinary mantle can be made incandescent with the aid of methylated spirit, is undoubted, and the introduction of such a piece of apparatus at a low figure is likely to meet with considerable success. The "Meta" lamp works on a tray, like an ordinary lime-light jet, and can be therefore used in either the enlarging or projection lantern. It gives an extremely intense light and in districts where gas is unobtainable its applications will be very numerous. The construction of the lamp is shown in the figure. The spirit is contained in the square reservoir

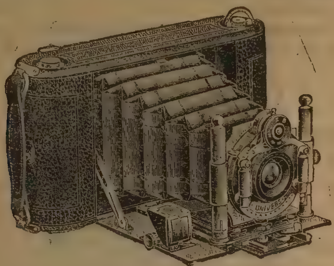


and after this has been filled with methylated spirit the pneumatic ball is screwed on. The sprit travels through the horizontal tube, which is packed with asbestos, and up the vertical tube, descending by a smaller tube to the Bunser burner by which the mantle is made incandescent. The spirit is vaporised at first by burning a little spirit on the fork covered with asbestos, seen below the burner. After the mantle has been made incandescent, it remains so, as long as the supply of spirit lasts. The power of the light is increased from time to time by forcing air into the reservoir by means of the pneumatic ball. The apparatus sells at 15s., and is very efficient.

THE FAIRFIELD FILM AND PLATE CAMERA.

(Sold by Hora & Co., 346, York Road, Wandsworth, London, S.W.)

This combination camera is abreast of modern ideas in providing for the exposure of both films and plates without separate acces-



sories. In the quarter-plate size submitted to us it has extension of 7¼ inches, rise and cross front movements, and focussing scale for films and plates. Other fittings are completely provided in the shape of reversible finder, Bausch and Lomb shutter, and carrying case for the three single slides. The price of the camera is £2 12s. 6d.

THE "STANDA" ROLL FILM TANK.

(Sold by Houghtons, Limited, 88 and 89, High Holborn, London, W.C.)

This ingenious piece of apparatus enables the photographer to apply the well-known method of stand development to roll films. It consists of an outer case of stamped steel, well finished and plated, and an inner part, which is a removable metal spiral of about the same height as the outer case, and of a length sufficient to take the size film for which it is intended. The exposed film and backing paper are wound on to this spiral in the dark room, by simply fixing one end to a catch-bar and unrolling the spool with the film outwards, round the metal until the middle is reached, or until all the film is unwound. The film, spool, and metal spiral are then placed in the outer case, which is fitted with developer. The lid is put on and the negatives are allowed to develop either by the "time" method or they can be inspected in the dark-room if necessary. When development is complete, the developer is replaced with water and then with fixing solution. The film is then wound off again, and the operation is complete. The film can be either washed before removing from the spiral or by any other method.

"FOCUSSING" COOKE LENSES IN SUNK FLANGES.

(Made by Taylor, Taylor, and Hobson, Limited, Leicester.)

The well-known Cooke lens has now been further adapted for use with cameras of the popular "fixed" folding type or instruments where the projection of the lens would be an objection. In its

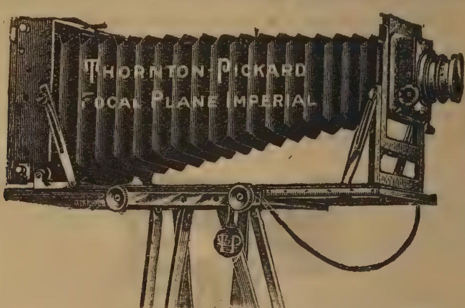
focussing form it already affords a unique addition to the camera of the fixed focus type, but by being now mounted, as shown in the illustration, so as to sit compactly against the camera front, its neatness is undeniable. The portion of the lens tube that projects measures 7-16th of an inch only, and this is the ring marked with focussing scale.

All focussing Cooke lenses are now supplied in this form at an extra cost of 4s. 6d., and for hand camera workers who appreciate the neat appearance of their outfit, combined with efficiency, this improvement is to be recommended.

THE "IMPERIAL" TRIPLE EXTENSION CAMERA.

(Made by the Thornton-Pickard Manufacturing Company, Limited, Altrincham.)

This camera has been specially designed and introduced to meet the requirements of those who desire to possess an inexpensive camera capable of giving both long and short extension, thereby allowing the use of lenses of great focal length, whilst being equally suitable for lenses of very short focus. In addition to these points every desirable



movement for all classes of photographic work are included and these various movements are operated and controlled by simple and ingenious mechanism of sound construction, which is not liable to get out of order. These movements include triple swing front, triple

swing back, rising, falling, and cross fronts, square reversing back triple extension 22in. in the ½-plate size), wide angle movement (taking lenses of 3in. focus) and revolving turntable. The apparatus is machine made throughout, thus ensuring mechanical precision in all its parts. Real leather bellows are an important feature in this outfit, and another special feature is the spring stretchers. These are fitted to both back and front and make the erection of the camera practically automatic. They lock at right angles to the base board, and should prove a great boon in practice, saving considerable time and ensuring the back and front falling into correct positions without any effort. The price of the outfit ½-plate size, including Beck symmetrical lens, T. and I. shutter, three-fold tripod and double book form slide, is 70s.

A NEW *f*/3 STUDIO LENS.

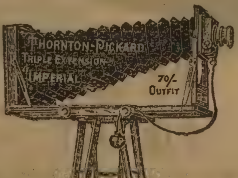
(Made by R. and J. Beck, Ltd., 68, Cornhill, London, E.C.)

As these pages are being prepared for the press, we receive from Messrs. Beck the No. 3 size of their new series of four lenses for portraiture. The instruments are of the Petzval type, but work at the very large aperture of *f*/3. The No. 3 of 8½ in. focal length is for cartes-de-visite or cabinets, and costs, with iris diaphragm, the sum of £7 10s. The Nos. 4 and 5 (12 in. and 16 in. focus) are for cabinets and 8½ x 6½ respectively, and work at the apertures of *f*/3.5 and *f*/4. The prices are £11 and £15. Although we have not had the opportunity of exhaustively trying the lens, we can say that the central definition is extremely fine. Naturally, the lens has not great covering power or depth, but for portraiture of children, and other subjects where the shortest exposures are desirable, it should stand the photographer in good stead.

THE FOCAL PLANE IMPERIAL TRIPLE EXTENSION CAMERA

(Made by the Thornton-Pickard Manufacturing Company, Limited, Altrincham,)

This camera is identical in every respect with the "Imperial" triple extension camera made by this firm, but in addition has a focal frame shutter (giving exposures from 1-20th to 1-1000th of a second), built in the camera body. It is a "two shutter" camera of remarkably low price, suitable for every class of work, including the



photography of objects for which the focal plane shutter is specially adapted. This outfit is made only in ½-plate size, and costs 85s. complete, with the same specifications as the "Imperial" triple extension outfit.

A NEW DAYLIGHT ENLARGER.

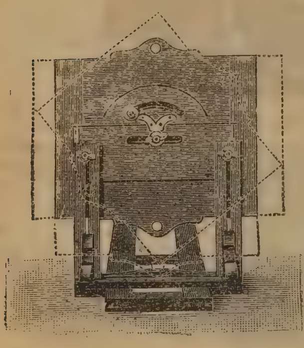
(Made by Lancaster and Son, Limited, Birmingham.)

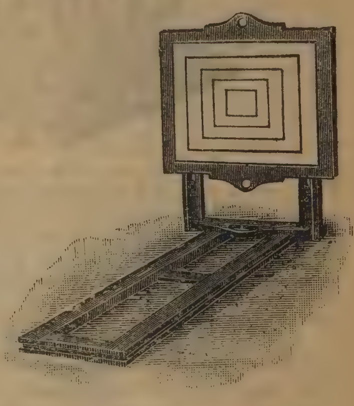
This daylight enlarger, which is put on the market at the low price of 35s. for the 15 by 12 size, contains all the good points of the well-known Multum-in-Parvo apparatus. It is, however, neater in design, and is fitted with focussing adjustment, enabling any size enlargement to be made up to the full size of camera. An ingenious self-centring carrier is a feature, enabling correction of negatives, or enlargement of any particular portion. It is supplied complete with special enlarging lens and diaphragms with exposing shutter. The 10 by 8 size costs 25s., and the 12 by 10, 30s.

X.L.O. ENLARGING AND COPYING STAND.

(Made by Lancaster and Son, Limited, Birmingham.)

The principal point of novelty in this stand is in the movements that have been devised for the screen. By a series of ingenious, yet simple, slots and pins, it is possible to move the screen into any position and clamp it securely, so that it remains perfectly rigid. The screen is fitted on a grooved base-board, and the ruled cardboard screen for taking prints from 15 by 12 to ¼-plate should prove of great



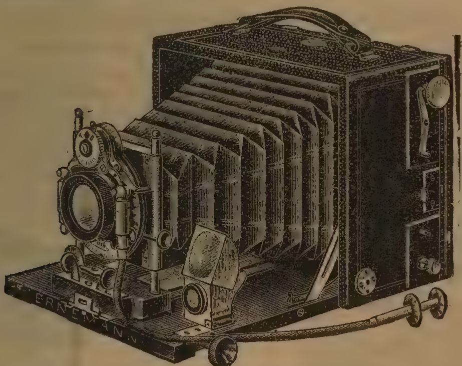


convenience for centring the point. It is made in both plain wood and polished mahogany. The illustration gives an idea of its construction, and it will be found quite an easy matter to fix the ordinary camera to the base-board for use. To take up to 12 by 10 pictures, it costs 16s. complete in polished mahogany, or 14s. in hardwood, polished. The largest size—to take 20 by 18—costs 30s. in mahogany, or 25s. in hardwood.

THE HEAG VI. DOUBLE SHUTTER CAMERA.

(Sold by Chas. Zimmermann & Co., 9 and 10, St. Mary-at-Hill, London, E.C.)

The "Heag" series of cameras are of the folding-box pattern, and range in price from 35s. to £16 15s., the price of the 5 by 4 size with Heliar $f/4.5$ Anastigmat. The Heag VI. submitted to us is a quarter-plate camera, with both focal-plane and lens shutter, a duplication of exposure fittings which is often desirable. The focal plane shutter is the Ernemann pattern, with adjustable slit and tension for exposures of 1.25, to the smallest fractions of a second, the alteration in the width of slit being by the well-known movement of the winding key working on a different gear wheel. The lens shutter is of the diaphragm type, placed between the glasses of an Ernemann doublet or other lens. The body of the camera is strongly made in wood, and permits a bellows extension



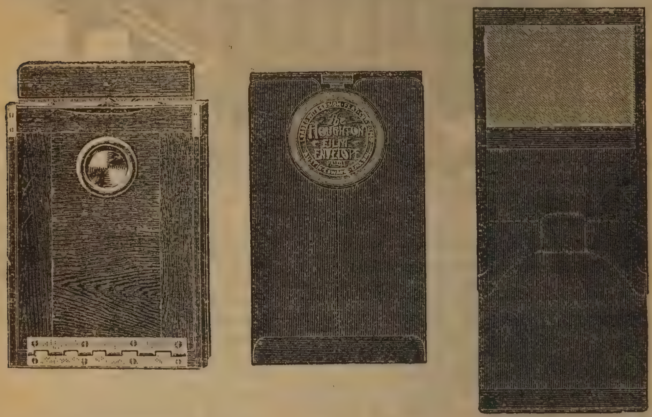
of 10 inches, and ample cross and rise movements of the lens board. The camera carries a focussing screen and double metal dark slides, either of which is covered by a hinged back of the apparatus. The whole instrument when folded for carrying measures $3\frac{1}{4}$ x $4\frac{1}{2}$ x $5\frac{3}{4}$ inches, and weighs 35 ounces. It is thus a convenient camera for really serious work in the hand or on a tripod. The price, with three slides and case, but no lens, is £3 10s.; with Ernemann double anastigmat, $f/6.8$, £7 15s.; with Goerz Series III. $f/6.8$, £8 15s.

THE HOUGHTON FILM ENVELOPE AND ADAPTER.

(Made by Houghtons, Limited, 88, 89, High Holborn, London, W.C.)

This ingenious method of employing flat cut films in the camera is likely to commend itself to all photographers who desire compactness and reliability in their apparatus combined with the ability to carry and use an unlimited supply of films for immediate use without employing bulky slides or other devices and without having recourse to the dark-room. The films are supplied for this apparatus in envelopes of a novel construction, and these envelopes can be used

over and over again. Thus any make of film specially favoured by the photograph can be used, although the Austin-Edwards flat cut films are specially recommended by Messrs. Houghton and are supplied in the envelopes ready for use. An adapter is necessary, and this takes the form of an extremely neat and simple box, smaller than most wood dark slides. It fits on the back of the camera in the place occupied by the dark slide, and is extremely neat and unobtrusive. It is constructed of polished mahogany with an aluminium draw and shutter in the front. The back opens by means of a spring catch at the top of a hinged panel. The film envelope containing the film is laid in the open adapter, and the back closed. The draw-out shutter and the projecting portion of the envelope are



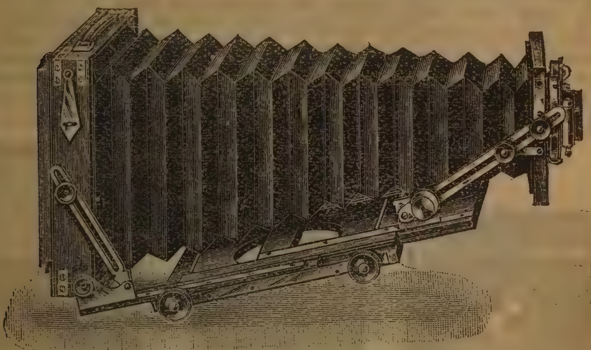
pulled out together and the exposure is made. After the exposure is made the slide is pushed home again. The back of the adapter is opened, the envelope and film removed and another substituted. Any number of loaded envelopes can be carried and they are easily opened in the dark-room for development of the films. The envelopes can then be re-loaded and are ready for use again. The simplicity and reliability of this new method of carrying and exposing cut films needs only to be seen and demonstrated to convince every camera worker that it is a means to be employed in the future whenever films are wanted. The price of the Adapter is 8s. 6d. $\frac{1}{4}$-plate size. Film envelopes, loaded complete with "Ensign" flat cut films, are supplied at 3s. 6d. per dozen. The Adapters can be fitted to almost any camera adapted for using dark slides.

THE "EMPIRE" TRIPLE EXTENSION CAMERA.

(Made by Lancaster and Sons, Limited, Birmingham.)

The amateur photographer who desires a camera possessing a multiplicity of movements and at the same time not too expensive,

should be satisfied with this latest product of the firm of Lancaster. Practically every movement that any kind of photography is likely to demand is to be found in this camera. In fact, it would be interesting to know exactly what special type of photographer exists who really needs them all. Back and front swings, rising and falling



across front, wide angle movements, triple extension reversing back, are some of the features, and in addition a most ingenious device is fitted to the front to permit of clamping it firmly and securely when in any position. The camera is strongly and well built of mahogany, and the bellows are of leather. The prices include camera, R.R. lens, shutter, tripod and slide, and are 50s. for ¼-plate, 70s. for ½-plate, and 90s. for 1-1 plate.

THE SERIES I. OMNAR ANASTIGMAT.

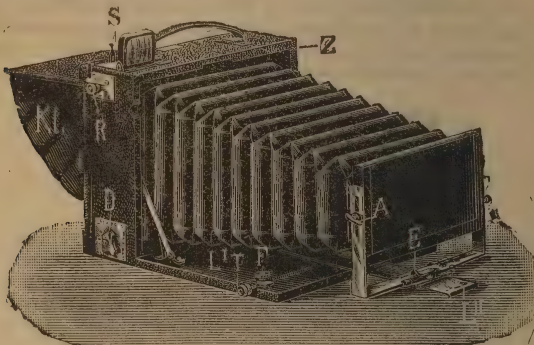
(Sold by the Busch Optical Company, 33, Charles Street, Hatton Garden, London, E.C.)

The several series of Busch Anastigmats are now issued under the title of Omnar. Series III., working at $f/7.7$, is a lens of whose optical properties we have held and expressed high opinion, and now that the makers have satisfied the demand for a large aperture in the Series I., $f/4.5$, there is good reason for anticipating a repetition of the satisfaction accorded to the less rapid lens. The Series I. "Omnar" is made in four sizes, at 5⅛, 6, 7½, and 10 inches focal length. The No. 3 of 7½ inch focus, which we have had under examination, covers a half-plate well at its full aperture, the field of definition increasing as a smaller stop is used. The lens is thus well suited for rapid hand camera work, and portraiture at full aperture, while with a smaller diaphragm it should answer well for such work as architectural photography. Each combination is separately corrected for use as a single landscape lens of focus about 1¾ times that of the whole lens. The price of the 7½ Omnar in ordinary mount is £7 10s.; the 5⅛ inch lens for quarter-plate is priced at £4 10s.; or £5 5s. in focussing mount.

THE FAIRFIELD FOCAL-PLANE AND STEREOSCOPIC CAMERA.

(Sold by Hora & Co., Limited, 346, York Road, Wandsworth, London, S.W.)

The above piece of apparatus is offered to those desiring a folding camera suitable for half-plate and stereoscopic work, for use in hand or on stand, and permitting exposures considerably shorter than can be obtained with the usual lens shutter. Moreover, this combination of qualities is offered at a moderate price. The camera is built of the pattern shown in the figure, and at its full extension separates the lens board from the plate by slightly over 12 inches. The lens board has about 1½ inch rise at A, at which point also it can be



swung. The focal-plane shutter is mounted in the specimen submitted to us rather differently from the generality of these accessories: the blind is wound up at the base of the camera and the slit moves upwards in exposing the plate. The adjustment of speed between the marked limits of 1-25th and 1-600th of a second (there are two intermediate speeds of 1-75th and 1-250th of a second) is made by altering the tension of the actuating spring, and for focussing there is provided an aperture in the blind the full width of the plate. The camera is supplied without lenses, and with three double dark slides of the draw-out pattern for £3 3s.

THE SHORT PORTRAIT LAMP.

(Invented and sold by M. Short, Pavilion Studio, Ramsgate.)

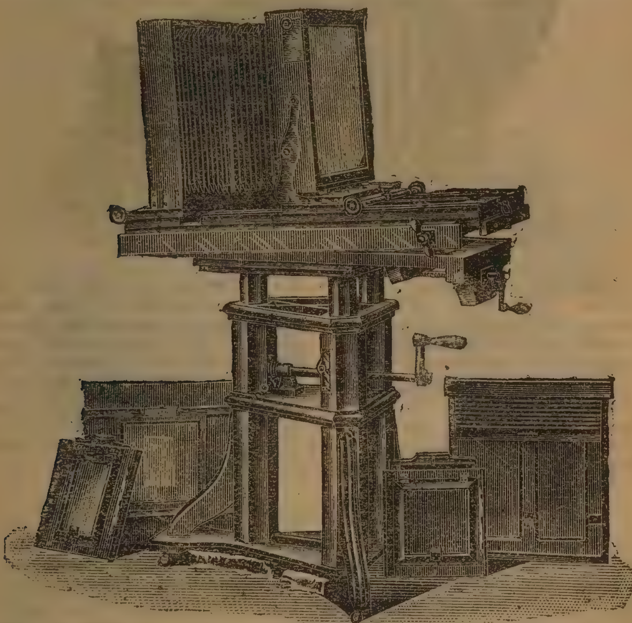
This lamp consists of a light metal chamber about 8 inches deep and measuring 30 x 30 inches when expanded for use, but closing to a parcel of 16 x 16 x 4, is readily carried in the hand. The front of the chamber is covered with a diffusing fabric, the area of which (30 x 30 inches) gives a very soft illumination on the light in the interior being produced. A magnesium powder is employed as the illuminant, and is fired in an ingenious way, which effectually reduces the escape of smoke or fume to insignificant proportions. A small

door in the back of the chamber has attached to it a small spirit lamp. The door being open and the sitter ready for the exposure, pressure on a pneumatic bulb opens and closes the lens, and at the same moment the door is closed and the flame of the spirit lamp brought down on the heap of flash powder. Thus the chamber is a closed space, and the escape of smoke from a few points is not a great source of inconvenience. The lamp is mounted on a metal telescopic tripod, by which it can be placed 7 or 8 feet from the ground. Price of the complete apparatus, lamp and stand, £4 4s. A demonstration of the lamp and examination of a number of specimens go to prove to us the reliability of the installation.

THE "FORWARD" STUDIO CAMERA.

(Made by O. Sichel & Co., 52, Bunhill Row, London, E.C.)

This fine piece of apparatus is British made throughout, on this fact the makers pride themselves, and justly so. The instrument is thoroughly well made and presents a handsome appearance that makes



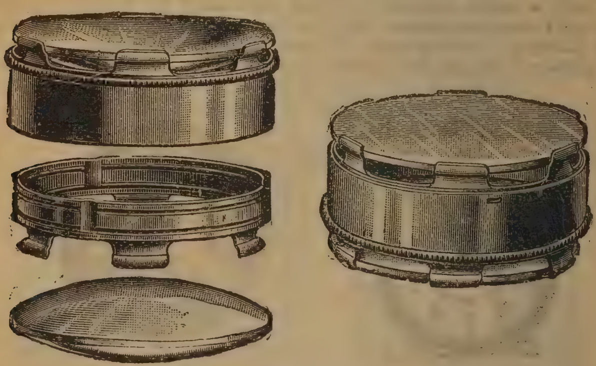
it a desirable piece of furniture for any studio. It is made of well-seasoned mahogany with brass bindings and fitted with double

swing and repeating back. One back is for slides holding carriers for $8\frac{1}{2}$ by $6\frac{1}{2}$ and $6\frac{1}{2}$ by $4\frac{3}{4}$ plates, and another special back with roller shutter contains carriers for larger plates. Both backs can be easily fixed and removed by simply turning a screw, or pressing them into a spring. The smaller back is fitted with a hinged focussing glass, and a special focussing glass is supplied for the larger, which fixes in the same way as the back itself. The front part is movable and the back moves with a substantial rack and pinion. The lens can be lowered or raised and is fixed in a very simple and ingenious way. The square bellows is of leather and supported by a patent arrangement which prevents it from sagging. The camera extends to double its normal length. The stand is handsomely finished in black ebonised wood and is fitted with a reliable tilting system. The prices of the camera and stand, etc., are £25 for the 12 by 12 size, up to £40 for the 24 by 24.

THE HOLBORN CONDENSER.

(Sold by Houghtons, Limited, 88 and 89, High Holborn, London, W.C.)

In the Holborn Condenser the glasses are held by a series of claws quite away from the metal ring. In this way the risk of breaking lenses is reduced to a minimum owing to their perfect ventilation. The draught between the two glasses prevents them becoming too hot, and stops moisture from settling on the surfaces. Among the points of advantage of this form of condenser may be



noted—the simple method of fitting the cells together, the usual trouble of screwing being entirely done away with. In case of accident, damaged lenses are very easily replaced, the absence of the usual rim of the metal ring allows the full aperture of the lenses to be used, and exceptional facilities for cleaning the lenses are presented. They are not expensive, the 4 in. condenser costing only 6s. 6d., and the 6in. 25s. The intermediate sizes are supplied at proportionate prices.

THE WATKINS DARK-ROOM CLOCK AND FACTORIAL CALCULATOR.

(Made by the Watkins Meter Company, Hereford.)

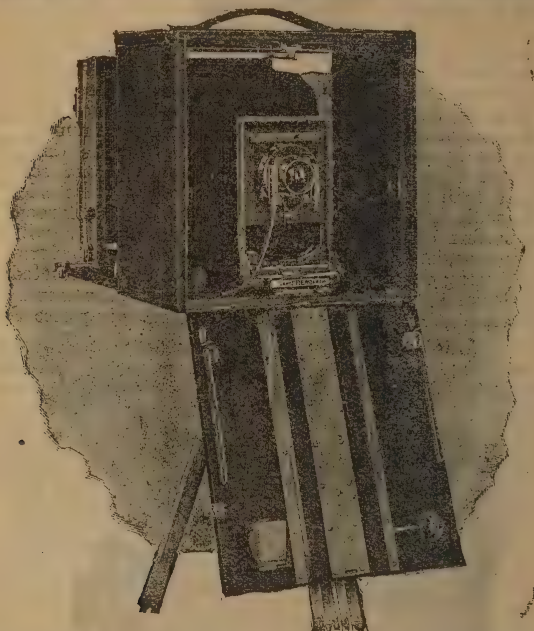
There is no doubt that factorial development is slowly but surely receiving recognition among every class of photographer. To Mr. Watkins is due many of the little helps to make smooth the path of the worker who desires exact results with as little trouble as possible, and in the new dark-room clock and factorial calculator a further incentive to rely on what may be termed mechanical methods is introduced. The times of complete development, with various factors and times of appearance, are seen at a glance, and moreover, being made of bright aluminium with the figures stamped in relief, can be seen easily in the dark-room. The outer scale of the calculator is a scale of factors, and is also used to denote the total time of development in minutes. The inner movable scale denotes time of appearance, either in seconds or minutes. In use, the pointer is set to the Watkins factor for the developer, and against the time of appearance given on the inner scale will be found the total number of minutes to develop. This calculator can be used with an ordinary watch, but the new dark-room clock (a former pattern of which was called the eikronometer) will be found not only a useful adjunct to every dark-room for various purposes, such as timing exposures, etc., but is specially constructed to facilitate factorial development. It has many improvements over the old pattern. It has two hands, one of which completes the revolu-

tion in one minute, while the other takes ten minutes The face of the clock is large, and the figures are plainly marked for use in the dark-room light. The ten minutes dial is enough for the longest ordinary development. A stop-motion permits both the hands to be started from zero as the developer is poured on. Legs are provided at the back to allow the clock to be used face up—the most convenient position in a dark-room. It is an English-made clock, and sells at 10s. 6d. The Factorial Calculator costs 2s.

THE CENTURY "GRAND SENIOR" CAMERA.

(So'd by O. Sichel & Co., 52, Bunhill Row, London, E.C.)

The salient features of this fine camera we have already touched upon in last year's "Almanac." Several small points of improvement have since been added, and the camera is now as complete as can possibly be desired for every class of work in addition to which its construction and finish are of the best. While differing in construction from the regular "Grand" Century Camera, the "Senior" contains all the features that have made that instrument popular both in America and here, and in addition has detachable side arms for dropping the bed of camera; supplementary bed for using extreme



wide angle lenses, with a novel rack and pinion movement; a vertical central swing back and horizontal side swing for correcting violent perspective lines. The telescopic bed is made in three sections, all operated by a single pinion with a patent pinion lock. The same amount of friction therefore exists whether the front section is fully or only partly extended. The revolving back is a special feature of the Century cameras, and this model, including a double plate holder and plush-lined leather case, is sold complete with Centar lens, Series II., at £10 in the 5 by 4 size.

A PINHOLE "LENS."

(Made by the Watkins Meter Company, Hereford.)

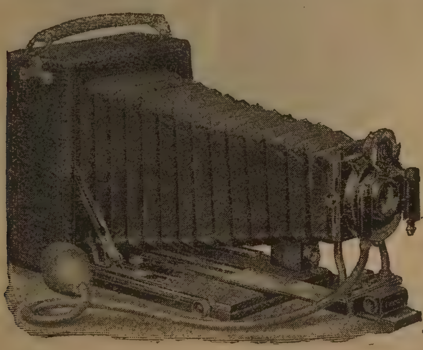
Mr. Watkins has put on the market a series of pinholes, each in a separate mount, of a kind that is instantly attached to a lens-hood not larger than 2 in. The pinholes are conveniently marked on a system, evolved jointly by Mr. Watkins and Dr. D'Arcy

Power, of San Francisco, according to which the number on the pinhole is multiplied by the focal extension. The product is used as the *F* number in calculating the exposure in the usual way, save that the result in seconds is taken as minutes. The convenience of this plan, and of the pinholes themselves, which can be carried without fear of damage, recommends the new accessory to those wishing to adopt the stenopaic method in negative-making.

THE "PETITE" CENTURY CAMERA, No. 3.

(Sold by O. Sichel & Co., 52, Bunhill Row, London, E.C.)

This little camera is not only a reliable hand camera that can be used on all occasions for snap-shot work, but it embodies—and in a remarkably small space—all necessary movements for nearly



every other kind of practical work. It possesses double extension and rack and pinion movements, swing back and a swing bed. An automatic diaphragmatic shutter is fitted and the lens is a rapid

symmetrical of good covering power. The bellows are of sufficient length to use the back combination of the lens supplied and a self-locking pinion is a feature that will be appreciated by the user. The camera is adapted for glass plates, the film pack or cartridge roll holder. It is handsomely finished in black leather and the inside is polished with lacquered metal fittings. The price for ¼-plate size is £3 18s.

THE "RYSTOS" ELECTRIC DARK-ROOM LAMP.

(Made by Reynolds and Branson, 14, Commercial Street, Leeds.)

Some time ago we reviewed an early pattern of this lamp, and have for over a year continuously employed it for dark-room work, and bromide printing, etc. A new lamp, illustrated below, is very similar in design to the previous pattern, but has several small additional advantages and improvements that tend to make it invaluable in every dark-room fitted with electric light. Two

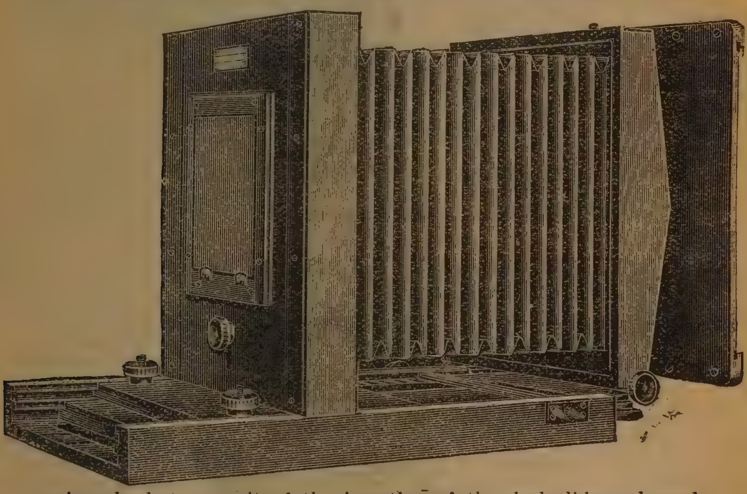
electric bulbs are fitted, one on top with reflector for white light, and the other inside for ruby light. The insulated switch handle on top is safe, and in the new pattern is well adapted for turning on the current to either ruby or white light, or instantly exchanging the one for the other by a small sliding movement. The ruby window gives a pleasantly soft but brilliant illumination, while

its semi-circular shape secures the lighting of the whole developing table. The lamp can be either placed on the table or suspended against a wall. "Gelatoid" filters to fit can be supplied if necessary, and electric lamps for any voltage are included. The lamp complete with all fittings measures, from base to top of outside light, about 14 inches. The working area of the ruby light is about $8\frac{1}{2}$ in. by 4 in., and the price is 18s. 6d., including flexible cord and connections for existing electric fittings.

THE "CITEX" STUDIO CAMERA.

(Sold by the City Sale and Exchange, 90-94, Fleet Street, E.C)

This is a studio camera made of Spanish mahogany, and is of massive build, being designed for heavy wear. It is of handsome appearance, and the workmanship—British throughout—is all that can be desired. All necessary movements for a complete studio apparatus are included, and the working adjustments are very smooth. It is of long extension, rack and pinion focussing; the double swing, together with the side swing, are both actuated by rack and pinion. A rising front is also fitted. The ground glass



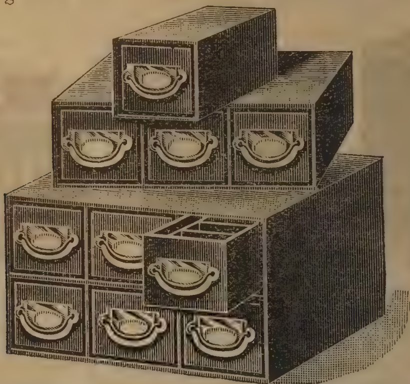
springs back to permit of the insertion of the dark-slide and need never be taken from the back of the camera. The slide is fitted with a perfectly reliable attachment to the repeating back, and any possible chance of making a double or wrong exposure is obviated. By a special adaptation, two half-plates may be used side by side in the smaller size. The camera is supplied in two sizes, viz., whole plate and 12 in. by 12 in., and is sent out with a complete set of masks and carriers.

The price of the smaller size is £5 17s. 6d. complete, and of the larger £9 5s. As a reliable London-made instrument it is extremely good value.

THE "PRIMUS" LANTERN SLIDE DRAW BOXES.

(Made by W. Butcher and Sons, Farringdon Avenue, London, E.C.)

These boxes are made of stout leather board and will stand a great deal of wear. As a convenient method of storing lantern slides they are everything that can be desired Each box has four compart-



ments and brass handle with title space in front. Any number of boxes can be stored one on top of each other, or they are supplied in nests of three and six. Each box will hold 50 slides. They cost only 8d. each.

"APTUS" INCANDESCENT CONTACT BROMIDE LAMP.

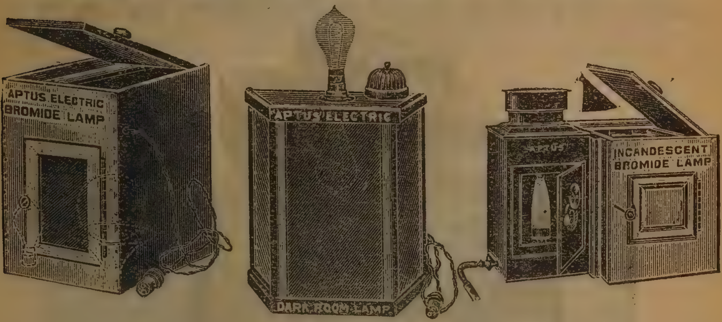
(Made by Sharp and Hitchmough, Dale Street, Liverpool.)

This lamp is specially designed for very quick work, and will take negatives up to whole plate. For printers of bromide or gaslight postcards it will be found of great service, as a great number of prints can be secured from one negative with practical uniformity. The apparatus is made of seasoned mahogany, polished and well finished. The ventilation has received special attention, and the light, which is situated at the side of the box, is reflected by means of a mirror up through a diffusing screen on to the negative. The negative is held in place in a carrier, and the sensitive paper is held in position on the negative by pressure of the hand on the lid of the box. A ruby glass cut-off enables the print to be centred and the exposure made. The chamber containing the incandescent gas burner is made of Russian iron with door at side. This is a very practical piece of apparatus, and sells at 35s. This price includes a carrier for half-plates.

The "Aptus" Electric Contact Bromide Lamp is similar to the gas lamp, but is without the Russian iron chamber, a specially

shaped incandescent electric light bulb and reflector being fixed at the bottom of the box. The light is worked automatically with the lid, which enables the operator to do very quick printing by merely pressing on the top of the box. The apparatus can also be used as a dark-room lamp, for which purpose it has a ruby glass door. It is supplied with fittings to attach to the ordinary electric lamp-holder. It is sold complete with two carriers for 30s.

The "Aptus" Electric Dark-Room Lamp, also illustrated above,



is a useful accessory for printing lantern slides, bromide or gas-light prints, etc. It is fitted with two standard holders for electric light bulbs, one inside and one outside, and a switch for automatically changing the light from one to the other. The size of front glass is 9 in. by 5 in., and ruby, yellow, and ground glasses are supplied. It costs 18s. 6d., with 2 yards of flexible wire for attachment to existing electric fittings.

THE "IDENTO" CAMERA.

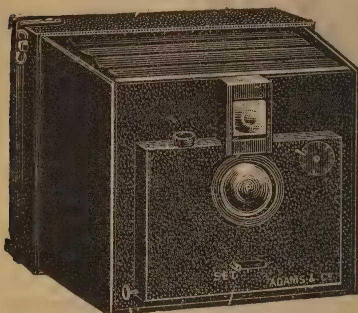
(Made by Adams & Co., 26, Charing Cross Road, London, W.C.)

In this camera the acme of portability appears to have been achieved without sacrificing any one essential that goes to make a really high-class and reliable instrument, capable of being employed not only as a hand camera, but in a more extensive field of operations. It is claimed, and the claim seems to be fully substantiated, that the "Idento" is the smallest complete folding or pocket quarter-plate camera ever designed.

One of the most striking of the new features introduced in this camera is the new type of finder—the Identoscope. When using the Identoscope finder, the identical view can be seen as it appears upon the plate, at all times, even when the rising fronts are used, either horizontally or vertically. It can thus be seen to what required extent the rising front need be used.

Each camera will take, without any alteration or addition whatever, either a changing box, double dark slides, daylight-loading roll holder, or Premo daylight-loading film-pack adapter. Thus any number of plates, flat, or rollable films, may be carried and

used, and at the same time it may be used as a stand camera, and objects focussed in the ordinary manner upon the ground-glass focussing screen, which is fitted with a folding hood, protecting it from light all round it. The instrument has vertical and horizontal rise and a level for horizontal and vertical pictures. The camera focusses from various close distances to infinity by a novel rack and pinion arrangement which ensures great exactness. The shutter gives exposures from ½ sec. to 1-100th sec., also time exposures. It opens and closes to the centre, without vibration, and is fitted with a protector. When the camera opens it is as fixed and rigid as a box camera, and can be most conveniently held and



manipulated; when closed, it is particularly small and neat. The lens is completely protected, and does not protrude.

The "Identoscope" finder is also self-contained inside the camera.

A plate can always be carried in position, ready to receive an exposure. The camera can be opened and closed very quickly. It pulls out to its infinity distance, therefore is at once ready for landscape work.

The complete camera body, together with lens, shutter, Identoscope, finder, and carrying handle only measures, when closed, 1⅞ in. thick, 5⅜ in. long, and 4 in. wide, and weights about 20 oz.

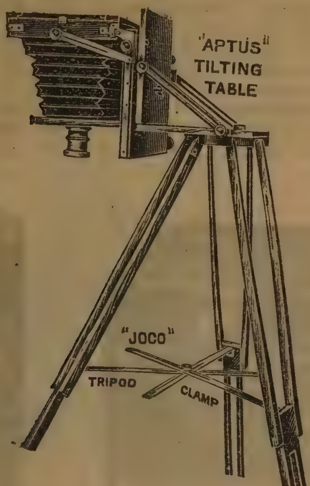
The price, including a 5 in. Ross Homocentric Lens, is £15, or £12 12s. for cash.

THE "APTUS" TILTING TABLE.

(Made by Sharp and Hitchmough, Dale Street, Liverpool.)

The illustration explains the appearance and object of this tilting table. It can be attached to any tripod top, and the camera is then affixed to the top of the table. This can now be tilted in any direction, and firmly clamped by the side struts and nuts. The camera can thus be pointed either up, down, or sideways, and

for photographing objects on the floors or ceilings, etc., its utility is unquestionable. For quarter and half plate cameras the price is 10s. 6d.; for larger cameras, 15s.



The "Joco" Tripod Clamp, also shown in the illustration, is another useful little piece of apparatus. Three slotted pieces of brass are fixed to the tripod legs at a convenient height, and these when brought together and clamped in the middle by means of a milled nut render the tripod perfectly rigid and incapable of sliding or opening out. It will prove invaluable when photographing on a smooth or polished floor, as in some interior work. It costs only 3s. 6d.

FOCAL PLANE CAMERAS.

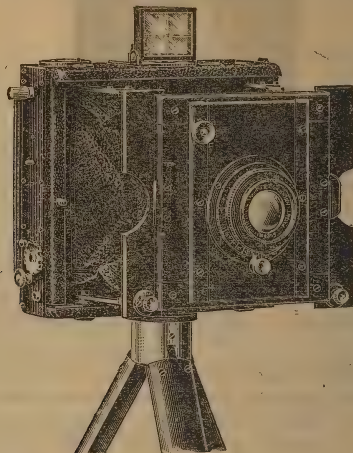
(Sold by Ross, Limited, Clapham Common, London, S.W.)

A new focal-plane folding camera, the "Victrix," is an instrument fitted with a shutter possessing a simplicity of adjustment such as qualifies it for being placed in the hands of a person inexperienced in photography. The method of using the shutter is as follows:—It is worked at one or other of two tensions, fast and slow, these tensions being obtained by (1) winding the spring key as far as it will go, and (2) letting it run down freely. The slit in the blind is adjustable by merely turning the winding key for a greater or lesser distance beyond the point at which the slit disappears. The further the key is turned the wider the slit, the successive widths being noted on a scale on the top of the camera. Each width of slit

taken in conjunction with the "slow" or "fast" tension gives a range of exposures from 1-33rd to 1-1100th of a second, the two series being plainly engraved in tables on the camera.

	1	2	3	4	5	6	7	8	9	10	11	12
Slow tension	1-800	1-720	1-520	1-260	1-175	1-130	1-88	1-63	1-52	1-44	1-38	1-3
Fast tension	1-1100	1-900	1-600	1-330	1-220	1-165	1-110	1-85	1-65	1-55	1-47	1-43

The shutter can also be worked at the full width of the plate for time exposures. In other respects the "Victrix" is a complete camera of its type. The finder fitted to it is worth a special mention. It is of the direct-vision pattern, but a mirror in its base springs up at an angle of 45 degrees on being released, and permits the operator



to view the picture when looking vertically down on the camera. The price of the "Victrix" complete with pneumatic release, three double dark slides, Ross "Homocentric" lens, Series C, *f*/6.3 and leather sling case is £11, in quarter-plate size.

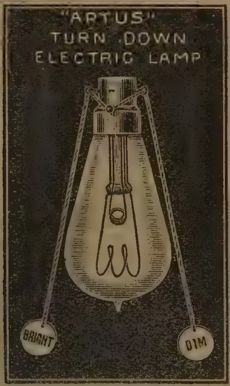
A new model of the focal-plane Ernemann camera has a focal-plane shutter with the same convenient system of altering the slit—viz., pressure on the left-hand knob and reversal of the winding key. Both these parts of the mechanism are now made with the minimum of projection, and the winding key ends in a large milled head for rapid setting of the shutter. The price of the quarter-plate camera with 5 in. Series C *f*/6.3 Homocentric lens, three double slides, and leather case, is £11 10s.

"APTUS" TURN-DOWN ELECTRIC LAMP.

(Sold by Sharp and Hitchmough, Dale Street, Liverpool.)

This novelty in electric incandescent lamps contains two filaments, one of the usual size, and the other of 1-candle power. A

switch is contained in the lamp cap for bringing one or the other filament into circuit, and this switch is actuated by a swing lever and hanging chains similar to those on incandescent gas lamps. It is claimed that a saving of 80 per cent. current is effected when the

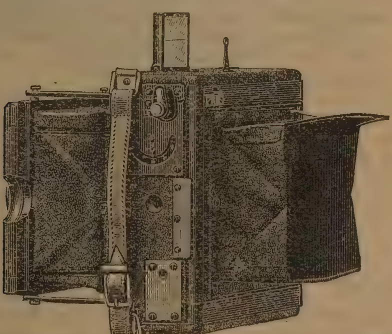


small filament is used. The lamps should prove of great use in the dark-room or bed-room. The lamps, as supplied, are of 16-candle power, and for voltages of 100, 200 or 250. They sell at 4s. each.

THE ERNEMANN FOCAL PLANE CAMERA.

(Sold by Charles Zimmermann & Co., 9 and 10, St. Mary-at-Hill, London, E.C.)

The new model of this camera is an improvement in several important though inconspicuous details on the pattern to which a



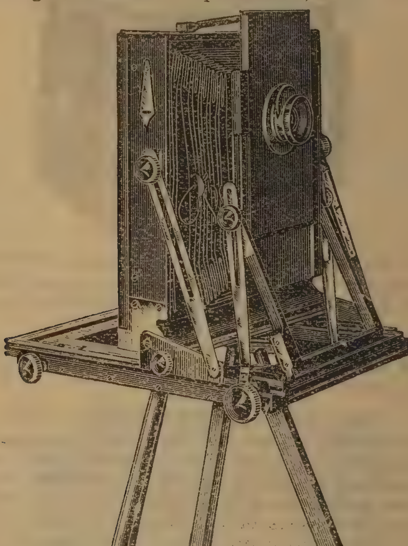
large measure of favour has been extended. In the first place the projection at the side controlling the alteration of the slit

in width is incased, as shown in the figure, and is thus safeguarded from accidental damage. The size of the camera—which means the dimensions of the back frame—is reduced, and the side pieces of the frame are now made each from one piece of metal, the camera thus gaining in strength and appearance. The other general features, including the extremely rigid extension of the front, are those of previous patterns, and the price of the quarter-plate size without lens remains at £5, with three double slides in leather case. It can be fitted with the Ernemann changing-box, taking twelve plates or twenty-four cut films at prices in proportion to that of the quarter-plate size at 45s.

THE TRIPLE EXTENSION "CENTURY" CAMERAS.

(Made by Ross, Limited, Clapham Common, London, S.W.)

This pattern of camera for landscape and outdoor photography is noteworthy, not for any strikingly novel construction, but for the embodiment of long acknowledged principles of camera design to a degree answering all modern requirements, and carried out in



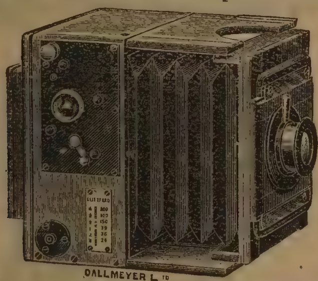
cabinetmaking of the finest description. The whole-plate triple-extension instrument submitted to us furnishes ocular proof of the success with which range of movement is obtained by a simple straightforward construction. In this size the full extension is 27 in.; by bringing forward the back of the camera this lens-to-plate distance can be made as short as 5 in. The camera has great rise, obtainable largely from a movement of the lens-board on the front, but when the front itself is raised the set screws which keep the side struts rigid

are not disturbed, a separate pair of nuts being provided for their adjustment. The cameras are listed in half, whole, 10 by 8, and 12 by 10 sizes at prices from £14 to £26 for turntable camera, three double slides, and tripod.

DALLMEYER'S FOCAL PLANE CAMERA.

(Made by J. H. Dallmeyer, Limited, 25, Newman Street, Oxford Street, London, W.)

Among the great number of folding focal plane cameras on the market, the above of Messrs. Dallmeyer's is distinctive for its solid and substantial construction, and for the fact that lenses of different focal lengths—from 3 to 6 inches in the quarter-plate size can be used with it. This advantage is attained by making the front and back equal in size and the guide flaps in the form of solid panels, between which the front can be fixed. The 1906 model is fitted with the new "Kershaw" focal-plane shutter, with speeds



regulated by an outside knob and adjustment for time exposures. Of British manufacture in all particulars, the new model camera is emphatically an instrument of the highest class for the traveller and tourist. While it is not a pocket camera, it is portable and readily packed with other luggage, and it is, first and foremost, strongly and durably made. The price is still £7 10s., with three double slides, but without lens.

THE KODAK TANK DEVELOPER.

(Made by Kodak, Limited, 57-61, Clerkenwell Road, London, E.C.)

In this pattern of developer, the process is practically automatic. The handle-turning operation during development is obviated, and the entire film is developed in a vertical position while stationary.

The apparatus consists of a flanged reel, upon which is wound a long red celluloid strip or apron. A wooden box is supplied in which the film and black backing is wound from the camera spool on to this reel, and is protected from light by the red celluloid. So far, the operation is somewhat similar to that which takes place in the developing machine. After the film has been transferred from the spool to the reel, it is removed from the winding box, and can be handled with perfect safety in the light of an ordinary room.

The flanged reel is now removed entire (containing the apron, the black paper, and the film), and is inserted in the developing tank,

as shown in the illustration. The tank is not unlike a jam-pot in shape, but is highly finished and electro-plated.

Previous to inserting the reel, the tank is three-parts filled with developer. The reel is gently lowered into the solution, which quickly finds its way to all parts of the film, as the edges of the red

celluloid apron are separated by strips of serrated rubber, and development proceeds slowly and evenly. At the expiration of every two or three minutes it is recommended to withdraw the reel and replace it again upside down. With the developer recommended and supplied by the Kodak Company, development will be complete in twenty minutes. There appears to be little danger of fogging or sticking with this method.

When development is complete, the developer is poured off and the tank filled and emptied two or three times with clean water. The film can then be unwound, separated from the black paper,

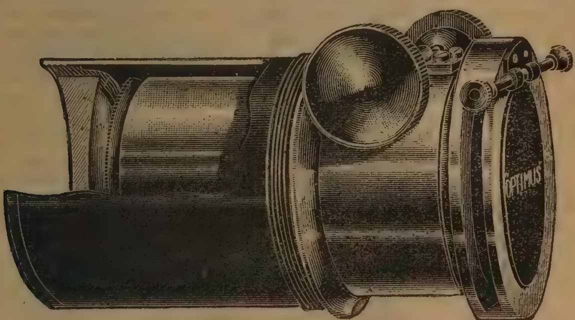
and cut into lengths for fixing in the ordinary way. These operations can be conducted in the light of an ordinary room, and no harm will come to the negatives.

Washing and drying are carried out in the ordinary way, and the film user who has not yet experimented with this form of development will be both astonished and pleased at the uniformity of the results obtained. The entire apparatus is produced with that finish and regard for details for which the Kodak Company is famous, and as it fulfils all that is claimed for it, the new developing tank should have a ready sale. The complete outfit is supplied in three sizes—the Brownie tank for No. 1 and No. 2 Brownie spools, the $3\frac{1}{2}$-inch tank for all spools up to that size, and the 5-inch tank for spools not exceeding 5 inches, the prices being 10s., 20s., and 25s. respectively.

THE "OPTIMUS" MULTIFOCAL LENS.

(Made by Perken, Son & Co., Hatton Garden, London, E.C.)

This telephoto lens for the lantern consists of a negative lens of large diameter in connection with an ordinary portrait objective.



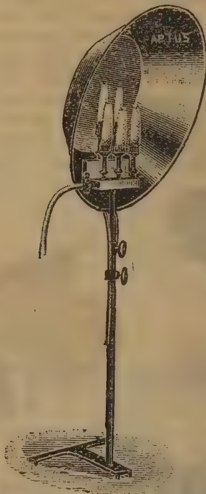
Both lenses are of excellent quality and well mounted in brass. The hood is fitted with a flash shutter, as also with a slot for coloured glasses. The only adjustments necessary to obtain pictures of different sizes at one position of the lantern or of the same size at different positions of the lantern are the separation of the positive lens from the negative and an extra draw of the whole objective such as any good lantern permits. The price of the complete lens is £2.

"APTUS" ARTIFICIAL APPARATUS FOR INCANDESCENT GAS.

(Made by Sharp and Hitchmough, Dale Street, Liverpool.)

This piece of apparatus is an improvement on the last year's model. The lights are bunched together instead of being spread over the surface of the reflector, and an arrangement has been made whereby the pressure of gas is made equal for each burner. Five

incandescent burners of 150 c.-p. each are fitted, and there is an air regulator for adjusting the flames. One by-pass serves for all the lights, which are also adjustable separately, and more burners



may be added at an extra cost. Short exposures can be made in the studio with ease with this apparatus, which is cheap at £3 5s.

THE "TAQUTA" AUTOMATIC CAMERA.

(Sold by Jonathan Fallowfield, 146, Charing Cross Road, London, W.)

The "Taquta" camera is an instrument taking ferrotype positives direct. The portraits are 1-inch circles, and are taken on dry plates, 45 of which are carried in a magazine, and can be loaded one by one into the camera in daylight. The "Taquta," however, is not only a camera; it provides for the development and fixation of the plate, with the result that a finished picture can be completed on the spot within a few minutes. And yet the whole apparatus is not so large but that it can be conveniently carried in the pocket. Fig. 1 shows the general construction of the camera. The lens is at A, and the magazine is placed by the side of the chamber, and the automatic changing M carries a plate before the focussing screen K; it is then dropped down into the cradle F, and is developed in the developing tank D. The lens works at the large aperture of F/4.5, but its short focus permits of all objects beyond six feet being rendered sharp at the same time, whilst the sliding tube allows nearer objects to be focussed.

The apparatus is loaded by placing a magazine of plates in C with the open end near M, closing the lid of the magazine, inserting the spring (in the cap B) through the hole in the magazine, and press-

ing on the back until the cap can be replaced. Underneath the camera the large tank with the cradle therein (see Fig. 3) is now fixed. The first compartment holds developer, the second fixing solution. The plate is brought into position by drawing the knob M from left to right, and exposed by quickly pulling back a handle and letting go (the figure shows an arrangement slightly different from the apparatus before us). By now slightly pulling the tank D, the plate is caused to fall into the cradle, which is immersed in the developer. 15 or 20 seconds are allowed for it to develop, and the tank is then detached from the camera, and the plate quickly changed (in the cradle) to the fixer, keeping the finger over the cradle during the transference. About 20 seconds suffice

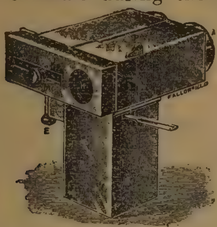


Fig. 1.

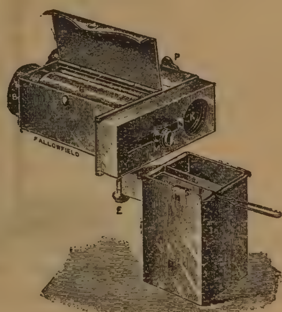


Fig. 3.

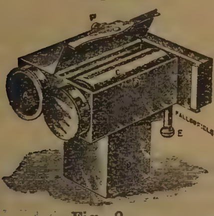


Fig. 2.

for fixing; the plate and cradle are washed for a minute or two in water, and the picture is then finished.

The printed description may make the process appear complicated, but in practice it is extremely simple. The developing formula is:—

Warm water	1 pint.
Carbonate of soda crystals	4 ounces.
Sulphite of soda	2 ounces.
Hydroquinone	¼ ounce.
Bromide of potassium	50 grains.
Hypo. fixing solution	½ fluid ounce.

Dissolve the carbonate and sulphite of soda, then add the hydroquinone and bromide, and when all are dissolved complete the solution by adding the hypo solution.

The plates are fixed in—

Hyposulphite of soda	5 ounces.
Water	1 pint.

The price of the "Taquta" in strong box complete, with magazine, containing 45 plates, is £1 1s.; extra magazines, daylight loading, 2s.; special light 3-fold tripod, 6s. 6d; special tin of "Taquta" developer for 10 oz. of solution, 6d.; 40 lign "Taquta" brooches complete, per doz., 2s. 6d.

As showing the profits to be obtained from the camera, the following figures from Mr. Fallowfield's circular may be quoted:—

EXPENSES.

	£	s.	d.
Cost of "Taquta" camera and 45 plates	£1	1	0
Cost of extra plates, 3 magazines at 2s.	0	6	0
Cost of 1 gross "Taquta" frames	0	15	0
Packing, carriage, developers free	£2	2	0

RECEIPTS.

	£	s.	d.
1 gross photos in frames at 1s.	£7	4	0
46 photos unmounted at 6d.	1	3	0
	£8	7	0

The photographs can be turned out at the rate of thirty per hour, so that 180 would be a very easy number to finish during a two days' bazaar, or during a single afternoon and evening, provided electric arc lamps can be used during the evening.

THE "MERITO" OPAQUE AND SPOTTING COLOURS.

(Sold by W. L. Parkinson & Co., 62, Dale Street, Liverpool.)

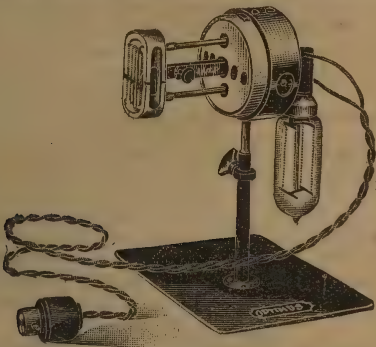
These colours have been introduced to enable the photographer to always have his spotting pigments in moist and good condition. They are put up in collapsible tubes, and in this form are both

economical and cleanly in use. They are packed in special boxes containing six opaque (red) and six spotting (brown-black) tubes at 3s. per box, or tubes can be obtained separately.

OPTIMUS ELECTRIC LAMP.

(Made by Perken, Son & Co., Hatton Garden, London, E.C.)

Messrs. Perken have designed a very convenient form of Nernst lamp which has the great advantage of lighting automatically. The dimensions are so moderate that it can be used in the body of any lantern. The pillar support is provided with adjustment for height,



and 12 ft. of wire is supplied, having a plug connection for the usual bayonet bulb-holder. The candlepower on a 200 volt current is 220, other voltages in proportion, and the price of the lamp complete for use is £1 10s. For enlarging (and projection on a moderate scale) a lamp of this kind is about the best illuminant it is possible to have. Our readers interested in the optics of the question will find a note emphasising the superiority of a light of moderate size over the theoretical point of light in "Epitome of Progress."

THE "PREMO" REFLEX CAMERA.

(Sold by Kodak, Ltd, 57-61, Clerkenwell Road, London, E.C.)

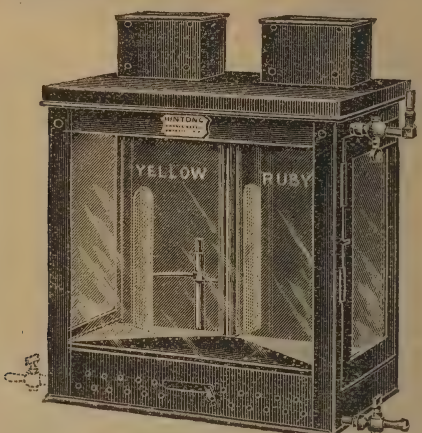
This latest introduction by the Kodak Co. embodies one or two points of novelty that are sure to appeal to the ever-increasing army of reflex-camera users. The instrument we have inspected was of 5 x 4 size, and although built to take a square reversing back was not at all bulky. An ingenious system of springs plus lazy-tongs actuates the hooded screen of the finder, so that releasing a catch projects this part of the apparatus into position for use with Jack-in-the-box rapidity. The chief feature of interest centres in the novel arrangement for the bellows extension. The front of the camera lets down and forms a base board. Coincident with this movement, the lens board and bellows (which, when closed up, are fixed to a hinged plate) are brought into view from the interior of the camera, and the front is racked forward in the usual way. To close the camera, the lens front is racked back to a certain position, and the base board shut up with all standing, and the bellows, front, and lens are tipped back into the interior of the box, which

appears capable of taking a lens of any reasonable size. The camera has a good extension, and the focal plane shutter works very smoothly. The release of the mirror and shutter is so arranged that there is practically no vibration, and it is impossible for the shutter to open before the mirror is up. The focussing arrangement falls easily to the hand on the left-hand side, and the release is conveniently placed on the right. The camera is handsomely finished in black grained leather, with plated metal parts. It is noticeably light in weight, and the price is £17 in 5 x 4 size.

THE "SWITCH" DARK ROOM LAMPS.

(Made by Hinton & Co., 38, Bedford Street, Strand, London, W.C.)

In these lamps a novel design is adopted to obtain an instantaneous change of the light from red to yellow, and at the same time to provide other conveniences. The lamp is made for oil, candle, gas, or electric light, and the special feature of rapid change of light is obtained in all patterns by changing the light from one compartment of the lamp to another. In the case of gas and electric light a burner is provided in each, and the gas supply or current switched from one to the other. In the oil pattern the lamp itself



is transferred from one portion to the other, the movement being very conveniently made by a lever on the front of the lamp. The illuminating area of the lamp is a piece of ground glass, behind which, as seen in the figure, the two ruby and yellow glasses are placed. As a result, a large flood of light is available, whatever light is employed. The lamp is made in four patterns: No. 1, for electric light, 35s., including three 8-c.p. glow lamps, for either 100, 200, or 250 volts; No. 2, for gas, 27s. 6d.; No. 3, for oil, 18s. 6d.; No. 4 for candle, 14s.

WHITBY, from Church Steps.

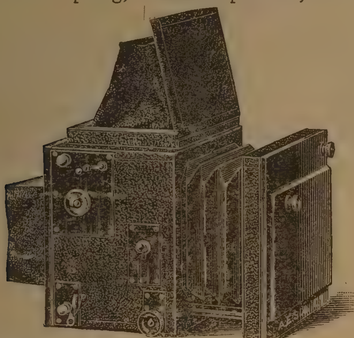
"GREAT EXPECTATIONS."

Specimen of
3-COLOUR BLOCKS
by
HOOD & CO., Limited,
St. Bride Works,
Middlesbrough

THE SICKLE REFLEX AND COLLAPSIBLE FOCAL-PLANE CAMERAS.

(Sold by O. Sichel & Co., 52, Bunhill Row, London, E.C.)

A reliable quarter-plate focal-plane reflex camera at a moderate price is the claim put forward for the Sickle camera, and one which we judge to be justly made. The price of the camera, without lens, is £5 10s., yet it possesses all the movements of a reflector camera of normal extension. The shutter adjustments on a camera of this class are, perhaps, the most important items, and in these respects the camera is well provided. The slit of the blind is adjustable from the outside of the camera, from 2 m.m. to the full width of the plate, which movement, in conjunction with the indicated tension of the spring, affords exposures, as tabulated for easy



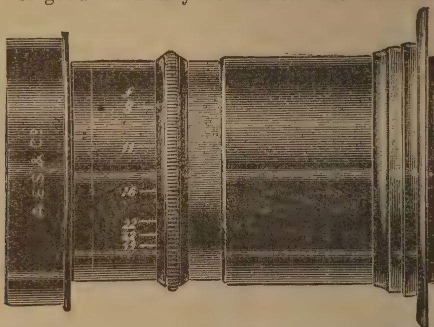
reference, of from 1-9th to 1-1000th of a second. Time exposures can be made with the shutter or with a cap. The focussing hood, shown open in the figure, folds flat with the top of the camera. The bellows extension amounts to some inches beyond the box body of the camera, and the front allows for rise and cross movement of the lens. A very light and convenient pattern of solid pull-out dark-slide goes with the camera, and is made in black ebonized wood, aluminium bound, or a changing-box or film-pack adapters can be used. The camera is made in quarter-plate only and can be fitted with most lenses of five to six inches focus.

PORTRAIT, RAPID, RECTILINEAR, AND ANASTIGMAT LENSES.

(Sold by A. E. Staley and Co., 19, Thavies Inn, London, E.C.)

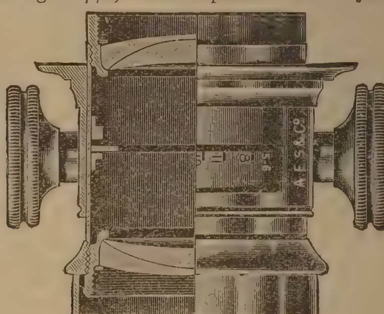
The Portrait "Planastigmat," of Messrs. Staley, is made in six sizes from 7 to $15\frac{3}{4}$ in. focus. That submitted to us for examination is the No. 3, of $10\frac{5}{8}$ in. focus, and specially adapted for cabinet portraits in short studios where the use of a lens of longer focus would be inadmissible. Inspection of the instrument shows us that the front combination is a cemented rather deep meniscus. The back component, as in the Petzval lens, has an air space, but the elements are differently arranged—practically reversed. On testing the lens

with its full aperture ($f/3$), we find that it yields remarkably good definition over a wide area in proportion to its focal length, and has a greater equality of illumination over the whole field it is intended to cover than is the case with the general run of portrait lenses of the Petzval type. The field is very flat, and the astigmatism is reduced to a minimum, rendering it an excellent lens for portraiture. With slight stopping down the lens will cover the whole plate well to the edges. A good word may be said for the mounting, which is



Rapid Rectilinear with adjustment for softness.

of aluminium in the more bulky portions, the tube itself being of brass. The diaphragm is of the iris pattern, and permits of the lens being stopped down to $f/36$. Our general conclusion is that the Portrait Planastigmat can be recommended to any one wanting a really good and rapid portrait lens at a moderate price. The lens is issued in foci of from 7 to $15\frac{3}{4}$ inches, the $10\frac{5}{8}$ examined by us, costing £13 10s. A second new lens of Messrs. Staley's is a rapid rectilinear, working at $f/8$, with a special draw adjustment whereby



The Universal $f/5.6$ Lens.

diffusion of definition is obtained by a greater separation of the lenses. With the lens mount at its shortest the picture is crisply

and sharply defined, but as the telescopic tube is more or less extended, the negative acquires a softness and roundness which must greatly enhance it for portraiture purposes. The lens is made with iris diaphragm, and in half and whole plate, the only two sizes issued, costs £2 and £2 15s. respectively.

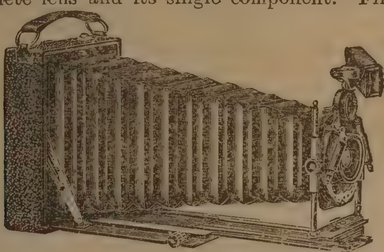
A "Universal Lens" for enlarging, projection, portraiture, etc., is a most useful form of objective for all kinds of work. Its largest aperture is *f*/5.6, sufficiently rapid for the great proportion of portraiture and enlarging, and one which has the great advantage of permitting the diameter of the lens mount being reduced. The lens is thus no larger than an ordinary R.R., and can be fitted to any camera, say, of the conical bellows pattern, having a small lens board. This feature should commend it to the user who can employ it on any of his existing apparatus, and to the dealer, who will find the same fact lighten his task of selling it. The "Universal" is made in five sizes, that for half-plate costing £4 10s.

The qualities and properties of the high-class modern anastigmat are exemplified in Messrs. Staley's "Planastigmat," which is an anastigmat doublet, working at *f*/6.8, at that aperture fully covering the plate for which it is listed. The "Planastigmat" is separable, either back or front combination can be used as a single lens of approximately double the focal length, and working at about *f*/13.5. A feature is made of supplying the "Planastigmat" in black sunk mounts when its destination is a folding or reflector focal-plane camera. No extra charge is made for this convenience.

THE SERVICE "GEM" POCKET PLATE CAMERA.

(Sold by the Service Photographic Society, 292, High Holborn, London W.C.)

The above is a camera of the hand stand pattern, compactly made, so that when folded its outside measurements are 4 x $5\frac{1}{4}$ x $1\frac{1}{2}$ inches in the quarter-plate size. Yet the extension is 10 inches and the front has double movement for obtaining rise and fall of lens, however the camera is held. The baseboard is doubly scaled for focussing both with the complete lens and its single component. Finder and level



are reversible for each position of the camera, and the lens, and R.R. working at *f*/8, is fitted with a shutter of the diaphragm type, and marked for exposures from 1 to 1-100th second. Complete with three double slides and focussing screen, the price of the camera is 75s. It is strongly constructed of light metal, and is quite an eligible instrument for tourist purposes.

DARK ROOM LAMPS WITH MIETHE FILTERS.

(Sold by A. E. Staley and Co., 19, Thavies Inn, London, E.C.)

Three patterns of dark-room lamps specially designed to take the "gelatoid" filters designed by M. Miethe deserve notice from the care expended in arranging an air current around the filters in such a way as to prevent heating, and so preserving the flatness of the gelatoid sheet. Many lamps are useless for these filters on account of the great heat to which they expose them. The new patterns are satisfactory in this respect, and are also excellent in their freedom

from leakage of white light. The air inlets and outlets are well trapped, yet perfectly obstruct any rays from the illuminant within the lamp. The lamps are fitted for oil, incandescent gas, and electric light, and each is provided with yellow, red, and green filters, all or any of which can be used at one time. The dark-room can thus be lighted as the sensitiveness of the plate or paper requires, and we have ourselves found the filters safe for the most colour-sensitive of plates. The size of the filter in the oil and gas lamps is 7 x 5 inches, and in the electric, 7 x 7. The prices of the lamps are: oil, 12s. 6d.; incandescent gas, 21s.; incandescent electric, 18s. 6d.

A RAPID PRINTER FOR BROMIDES, POSTCARDS, Etc.

(Sold by A. E. Staley and Co., 19, Thavies Inn, London, E.C.)

The essential feature of this piece of apparatus is a rotating disc with two windows, which serve as printing frames, and two corresponding openings underneath, one having red glass and the other white ground glass. The apparatus is used in the dark room. The red glass allows the operator to adjust paper and negative and vignette quickly and easily. Then the disc is rotated in $\frac{3}{4}$ to 1 second over the white window back to its original position, when the paper is removed and a fresh piece inserted. For the slower chloride gas-light papers, or for denser negatives, both printing windows are used, one print being exposed while another is being put in. The machine is intended to fill the gap between the large machines using bromide

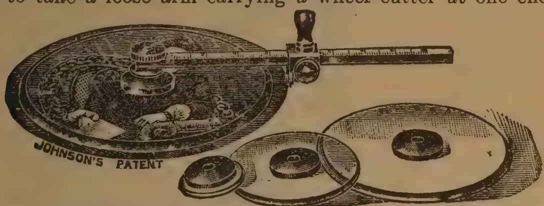
in rolls, and making prints by the thousand, and the ordinary printing by hand in the usual way, and it is claimed that 300 to 350 prints per hour can be taken off. The illuminant is a methylated spirit in-

candescent burner giving a very powerful light. The apparatus serves the purpose of a dark-room light in addition to its function proper of a printer. The price, complete with lamp, is £5 12s.

THE "VICTOR" CIRCLE TRIMMER.

(Sold by Charles Johnson, High Street Gillingham, Dorset.)

This is a well-made, practical piece of apparatus for rapidly cutting circular prints or thin mounts. Glass circles are supplied with central bosses to take a loose arm carrying a wheel cutter at one end. At



the other end of the arm is a pin which engages in a hole in the central boss. The glass plates are only used to hold the print down firmly, and not as a guide for the cutter. Circles of any diameter up to 9 in. can be cut, and the size is easily regulated by means of a sliding clamp on the loose arm. It is a useful little piece of apparatus, and is stocked by leading houses.

HEYDE'S "FACILE" EXPOSURE METER.

(Sold by A. E. Staley and Co., 19, Thavies Inn, London, E.C.)

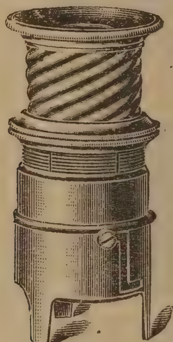
This instrument is an exposure meter conveniently arranged for determining exposure by the well-known principle of extinction. It consists of a circular case (made of magnalium). The scene to be photographed is observed through an eyepiece in the centre of the case, and by rotating the outer portion of the apparatus, a blue glass prism is moved over the viewing aperture. The prism cuts off more and more light as it is moved until a point is reached at which

detail in the shadows becomes undistinguishable. This position of the prism marks the actinic brilliancy of the subject, and from it is read off, on the scales of the instrument, the exposure for certain stops with a plate of rapidity 160 H. and D. The actual handling of the instrument is most expeditious, a few seconds sufficing to make the observation. As the prism alone may not be sufficient to cut off the light from such very bright subjects as seascapes, etc., a coloured glass is provided, and is brought in front of the prism so as to bring the subject within the range of the instrument. The observation is made in the same way, and, as with the prism alone, without arithmetical calculation of any kind. The price of the instrument, in a soft leather purse, is 17s. 6d.

FOCUSSING EYE PIECES.

(Sold by A. E. Staley and Co., 19. Thavies Inn, London, E.C.)

For many purposes of practical and scientific photography, a focussing magnifier is a *sine qua non*, and a handy form of this instrument soon becomes a valued tool. Messrs. Staley issue one in which a double purpose is usefully served. The barrel of the eyepiece carries a tripod, by aid of which the instrument can be laid firmly on an opaque surface on which light can fall through the legs of the tripod. When viewing the image on the ground glass, the



Focussing Glass with Tripod for Opaque Objects.

dot in half-tone negatives, etc., the tripod attachment falls over the mount of the eyepiece. The change from the "opaque" to the "transparent" position is made in an instant, and the nickel-plated magnifier costs 6s. A somewhat similar instrument, covered in leather and without the tripod attachment, also costs 6s. A third, and quite novel pattern, is a high-power magnifier, which at the same time, reverses and inverts the image on the ground glass, showing its correct position as seen by the eye. The price of this pattern is 8s.

⁎ *Owing to demands upon our space in this portion of the Almanac the continuation of these notices of new apparatus will be found on pages following the lists of photographic societies.*

DEVELOPING FORMULÆ FOR GELATINE DRY PLATES, ETC.

(*Arranged alphabetically.*)

The following are a few of the typical formulæ generally employed for development, etc. A much greater variety will be found in the section headed "Developing Formulæ of the Principal Plate-makers" (pp. 991 et seq.). In these as in other formulæ in the ALMANAC "sodium sulphite" without qualification refers to the "cryst" and "recryst" sulphite, and "sodium carbonate" to the crystallised carbonate.

It should be noted also that the metric weights are not equivalents of the British item for item, but that the two formulæ give a solution of the same composition.

ADUROL.

TWO-SOLUTION.

A.	Adurol	85 grs.	19.5 gms.
	Sodium sulphite	$1\frac{3}{4}$ ozs.	175 ,,
	Water	10 ,,	1000 c.c.s.
B.	Potass carbonate	$1\frac{1}{4}$ oz.	125 gms.
	Water	10 ozs.	1000 c.c.s.

For studio work and snap-shots take 1 part of A, 1 part of B.

For time exposures outdoor take 1 part of A, 1 part of B, 1 part of water.

ONE-SOLUTION (CONCENTRATED).

Sodium sulphite	4 ozs.	400 gms.
Potass carbonate	3 ,,	300 ,,
Water	10 ,,	1000 c.c s.

When all are dissolved add—

Adurol...	$\frac{1}{2}$ oz.	50 gms.

For studio work and snap-shots take 1 part with 3 parts of water.

For time exposures outdoor take 1 part with 5 parts of water.

AMIDOL.

A normal developer consists of—

Amidol	2—3 grs.	4.5—7.0 gms.
Sodium sulphite	25 ,,	57.5 ,,
Water to	1 oz.	1000 c.c.s.

As amidol does not keep well in solution it is advisable to keep a stock solution of sulphite and add the amidol just before use. Dissolve $2\frac{1}{4}$ ozs. of soda sulphite in 10 ozs. of water and dilute 1 oz. with 3 ozs. of water at time of use, adding 2 to 3 grs. of amidol per oz. of diluted solution.

For "Diogen" developer see page 989.

EDINOL.

ONE-SOLUTION.

Water	20 ozs.	1000 c.c.s.
Sodium sulphite	5 ,,	250 gms.
Edinol	96 grs.	11 ,,
Sodium carbonate	2 ozs.	100 ,,

For soft portrait negatives.

Water	20 ozs.	1000 c.c.s.
Acetone sulphite (Bayer) ...	288 grs.	33 gms.
Sodium sulphite	4 ozs.	200 ,,
Edinol	96 grs.	11 ,,
Potassium carbonate	2 ozs.	100 ,,
Potassium bromide	48 grs.	5.5 ,,

For contrasty negatives.

The ingredients should be dissolved strictly in the order given.

EIKONOGEN.

A. Sodium sulphite	2 ozs.	100 gms.
Eikonogen	$\frac{1}{2}$ oz.	25 ,,
Distilled water	20 ozs.	1000 c.c.s.
B. Potass carbonate	$1\frac{1}{2}$ oz.	75 gms.
Distilled water	20 ozs.	1000 c.c.s.

For use, mix equal volumes of A and B.

ONE-SOLUTION

Sodium sulphite	2 ozs.	100 gms.
Sodium carbonate	1 oz.	50 ,,
Distilled water	20 ozs.	1000 c.c.s.
Eikonogen	½ oz.	25 gms.

EIKONOGEN-HYDROQUINONE.

A	Hydroquinone	40 grs.	4.5 gms.
	Eikonogen	120 ,,	14.0 ,,
	Sodium sulphite	480 ,,	55. ,,
	Citric acid	20 ,,	2.3 ,,
	Water to	20 ozs.	1000 c.c.s.
B.	Potass bromide	5 grs.	0.5 gms.
	Sodium carbonate	60 ,,	7 ,,
	Caustic potash	30 ,,	3.5 ,,
	Water to	20 ozs.	1000 c.c.s.

For use, mix in equal parts.

FERROUS OXALATE.

A. Potass oxalate (neutral), 5 ozs. ; hot water, 20 ozs. Cool and pour off clear liquid for use.

B. Warm water, 20 ozs. ; sulphuric acid, 30 minims ; sulphate of iron, 5 ozs.

Mix 1 oz. of B with 3 to 4 ozs. of A (pouring B into A, not *vice versa*).

FOR TRANSPARENCIES ON GELATINE-CHLORIDE PLATES.

A.	Neutral oxalate of potash ...	2 ozs.	100 gms
	Ammonium chloride	40 grs.	4.5 ,,
	Distilled water...	20 ozs.	1000 ,,
B.	Sulphate of iron	4 drachms	34 grms
	Citric acid	2 ,,	17 ,,
	Alum	2 ,,	17 ,,
	Distilled water...	16 ozs.	1000 c.c.s.

For black tones mix the above in equal volume.

For "Hurter and Driffield's" Standard Ferrous Oxalate Developer see page 988.

GLYCIN.

ONE-SOLUTION (HÜBL).

Boiling water...	4 ozs.	1000 c.c.s.
Sodium sulphite	$2\frac{1}{2}$,,	625 gms.

When dissolved add—

Glycin	1 oz.	250 gms.

And then in small quantities—

Potass carbonate	5 ozs.	1250 gms.

This forms a thick cream, which must be well shaken and then diluted with water; for normal work, dilute 1 oz. with 12 or 15 ozs of water, for very soft results with 30 ozs. of water.

ONE-SOLUTION.

Glycin	1 oz.	33 gms.
Sodium sulphite	$2\frac{1}{2}$ ozs.	83 ,,
Potass carbonate	5 ,,	166 ,,
Water to...	30 ,,	1000 c.c.s.

For normal exposures dilute with an equal bulk of water.

HYDROQUINONE. 960

ONE-SOLUTION. 240

Hydroquinone	100 grs.	11.5 gms. 1200
Sodium sulphite	$1\frac{1}{2}$ oz.	75 ,,
Sodium carbonate	3 ozs.	150 ,,
Water to	20 ,,	1000 c.c.s.

May be diluted with an equal volume of water.

TWO-SOLUTION (CAUSTIC SODA).

A.	Hydroquinone	160 grs.	18 gms.
	Sodium sulphite...	2 ozs.	100 ,,
	Citric acid	60 grs.	7.0 ,,
	Potass bromide	40 ,,	4.5 ,,
	Water to...	20 ozs.	1000 c.c.s.
B.	Caustic soda (stick)	160 grs.	18 gms.
	Water to...	20 ozs.	1000 ,,

For use :—A, 1 oz. ; B, 1 oz. ; water 2 ozs.

ONE-SOLUTION (WITH FORMALINE).

Hydroquinone	130 grs.	15 gms.
Sodium sulphite	6 ozs.	300 ,,
Formaline	3 drachms	20 c.c.s.
Water to...	20 ozs.	1000 ,,

A slow developer specially suitable for line work.

KACHIN.

A.	Kachin	160 grs. (Avoirdupois)	9 gms.
	Sodium sulphite	$2\frac{1}{2}$ ozs.	62.5 ,,
	Water to	20 (fl.) ozs.	500 c.c.s.
B.	Sodium carbonate	2 ozs.	50 gms.
	Water to	20 ozs. (fl.)	500 c.c.s.

For use take equal parts of A and B. More diluted developer gives softer results. The solutions should be used at a temperature of 60 to 65 degrees F. Assuming exposure to have been correct, with this solution the image commences to appear in about one minute, and, when full density is required, development is completed in from 4 to 6 minutes. Softer effects are obtained in from 3 to 4 minutes. No restrainer is really necessary, but in the case of over-exposure, the use of a few drops of 5 per cent. solution of ordinary borax is recommended

IMOGEN-SULPHITE.

A.	Imogen sulphite	1 oz.	83 gms.
	Distilled water (warm) ...	12 ozs.	1000 c.c.s.
B.	Sodium carbonate	1 oz.	500 gms.
	Water	2 ozs.	1000 c.c.s.

For correct exposure, A, 2 ozs. ; B, 2 ozs. ; water, 4 ozs. For under-exposure or soft negatives, A, 1 oz. ; B, 3 ozs. ; water, 4 ozs. For over-exposure, A, 2 ozs. ; B, 2 ozs. ; water, 30 ozs. ; potassium bromide, 40 per cent. solution, 1 oz.

METOL.

One-solution (Hauff).

Metol	150	grs.	16	gms.
Sodium sulphite	2½	ozs.	125	,,
Sodium carbonate	3½	,,	175	,,
Potass bromide	16	grs.	2	,,
Water to...	20	ozs.	1000	c.c.s.

For portraits, take stock solution, 1 oz.; water, 1 oz. For landscapes, stock solution, 1 oz.; water, 2 ozs.

Two solution (Hauff).

A.	Metol	150	grs.	16	gms.
	Sodium sulphite	2½	ozs.	125	,,
	Water to...	20	,,	1000	c.c.s.
B.	Sodium carbonate	3½	ozs.	175	gms.
	Potass bromide	16	grs.	2.0	,,
	Water	20	ozs.	1000	c.c.s.

For portraits, A, 1 oz.; B, 1 oz. For landscapes, A. 1 oz.; B, 1 oz.; water, 1 oz.

METOL-HYDROQUINONE.

One-solution

Metol	35	grs.	4	gms.
Sodium sulphite	2	ozs.	100	,,
Hydroquinone	50	grs.	5.7	,,
Sodium carbonate	1½	oz.	75	,,
Distilled water to	20	ozs.	1000	c.c.s.

Two-solution.

A.	Metol	40	grs.	4.5	gms.
	Hydroquinone	50	,,	5.7	,,
	Sodium sulphite	120	,,	14.0	,,
	Potass bromide	15	,,	2.0	,,
	Water to...	20	ozs.	1000	c.c.s.
B.	Sodium carbonate	½	oz.	25	gms.
	Water	20	,,	1000	c.c.s.

Three-solution (Mortimer).

A.	Hydroquinone	180 grs.	20 gms.
	Sodium sulphite	3 ozs.	150 ,,
	Potass bromide	20 grs.	2.3 ,,
	Water	20 ozs.	1000 c.c.s.
B.	Metol	140 grs.	15 gms.
	Sodium sulphite	3 ozs.	150 ,,
	Water	20 ,,	1000 c.c.s.
C.	Sodium carbonate	3 ozs.	150 gms.
	Water	20 ,,	1000 c.c.s.

For correct exposures use equal parts of A, B and C. For over-exposure use two parts A and one part C. For under-exposure use two parts B and one part C, and dilute with an equal bulk of water

One-solution (Andresen).

Metol	160 grs.	18 gms.
Sodium sulphite	$3\frac{1}{2}$ ozs.	175 ,,
Potass carbonate	$1\frac{3}{4}$,,	87.5 ,,
Potass bromide	22 grs.	2.5 ,,
Water	20 ozs.	1000 c.c.s.

For use, take 1 part of developer to 3 of water.

Two-solution (Andresen).

A.	Metol	160 grs.	18 gms.
	Sodium sulphite	$3\frac{1}{2}$ ozs.	175 ,,
	Water	20 ,,	1000 c.c.s.
B.	Sodium carbonate	$3\frac{1}{2}$,,	175 gms.
	Water	60 ,,	3000 c.c.s.

One part of A is mixed with 3 parts of B, potass bromide being added as required for prevention of fogging.

ORTOL.

1. Ortol-Soda.

A.	Ortol	140 grs.	15 gms.
	Potass metabisulphite ...	70 ,,	8 ,,
	Water, cold	20 ozs.	1000 c.c.s.

B. Sodium carbonate	$2\frac{1}{2}$ ozs.	125	gms.
Sodium sulphite	$3\frac{1}{2}$,,	175	,,
Potass bromide	10...20 grs.	1.1—2.3	,,
Water	20 ozs.	1000	c.c.s.

100 minims of 1 in 2 hypo solution may be added to solution A, and is said to brighten the shadows, but this addition is of doubtful value.

In cold weather the potassium bromide may be left out.

For quick development take 1 part of A and 1 part of B. For slow and soft development take 1 part A, 1 part B, and 1 part water.

PARAMIDOPHENOL.

One-solution.

Potassium metabisulphite ...	6 ozs.	300	gms.
Distilled water	20 ,,	1000	c.c.s.
Paramidophenol	2 ,,	100	gms.

Dissolve in the above order and add gradually—

Caustic soda or potash... .. .. q : s

to dissolve the precipitate first formed.

For use, dilute 1 oz. with from 10–30 ounces of water.

Two-solution.

A. Paramidophenol hydrochloride	200 grs.	23.0	gms.
Potassium metabisulphite ...	100 ,,	11.5	,,
Distilled water to	20 ozs.	1000	c.c.s.
B. Sodium sulphite	$1\frac{1}{4}$ oz.	62.5	gms.
Potassium carbonate	$1\frac{1}{4}$,,	62.5	,,
Distilled water to	20 ozs.	1000	c.c.s.

For use, mix 1 oz. of A with 2 ozs. of B.

PYROCATECHIN.

Two-solution.

A. Pyrocatechin	175 grs.	20	gms.
Sodium sulphite	$1\frac{1}{2}$ oz.	75	,,
Water	20 ozs.	1000	c.c.s.

B. Potass carbonate	... ...	2½ ,,	125 gms.
Water ...	... ...	20 ,,	1000 c.c.s.

Equal parts are mixed together.

ONE-SOLUTION.

Sodium sulphite	... ...	5 ozs.	250 gms.
Water ...	... ...	20 ,,	1000 c.c.s.
Caustic soda	... ...	260–300 grs.	30.0–34.5 gms.
Pyrocatechin	... ...	400 ,,	46.0 ,,

The chemicals are dissolved in this order and the stock solution kept well corked. It is diluted with 20 times its volume of water for use.

PRYO-ACETONE.

A. Pyro	... ...	1 oz.	100 gms.
Sodium sulphite...	... ...	4 ozs.	400 ,,
Distilled water to	... ...	9 ,,	1000 c.c.s.

Potassium metabisulphite must not be used, unless neutralised, and there should be no addition of citric acid.

A normal developer consists of :—

Pyro	... ...	4 grs.	9.2 gms.
Acetone ...	... ...	40 minims	80 c.c.s.
Water ...	... ...	1 oz.	1000 ,,

and is made by measuring out 40 minims of A solution, adding 40 minims of acetone and making up to 1 oz.

PYRO-AMMONIA.

(10% SOLUTIONS.)

A. Pyro solution as for pyro-potash or pyro-soda.

B. Potass bromide ...	... ...	1 oz.	100 gms.
Distilled water to	... ...	9 ozs.	1000 c.c.s.
C. Liquid ammonia (.880)	...	1 oz. (fl.)	100 ,,
Distilled water to	... ...	9 ozs.	1000 ,,

To make a normal developer, take, A, 20 minims ; B, 10 minims ; C, 30 minims ; water to 1 oz. ; or if no bromide is used, A, 20 minims ; C, 10 minims, to water, 1 oz.

PYRO POTASH.

(10 % SOLUTIONS.)

A.	Pyro	1 oz.	100 gms.
	Potassium metabisulphite ...	1 ,,	100 ,,
	Distilled water to	9 ozs.	1000 c.c.s.
B.	Potassium carbonate	1 oz.	100 gms.
	Sodium sulphite	1 ,,	100 ,,
	Distilled water to	9 ozs.	1000 c.c.s.

A normal pyro potash developer consists of—

Pyro	2–4 grs.	4.6–9.2 gms.
Potassium carbonate	14 ,,	32.2 ,,
Water to	1 oz.	1000 c.c.s.

and is made by taking A, 20 to 40 minims; B, ½ oz.; water to 1 oz. With 5 minims 10 % potass bromide solution if necessary.

PYRO SODA.

(10 % SOLUTIONS.)

A.	Pyro	1 oz.	100 gms.
	Sodium sulphite	4 ozs.	400 ,,
	Distilled water to	9 ,,	1000 c.c.s.
B.	Sodium carbonate (cryst.) ...	1 oz.	100 gms.
	Distilled water to	9 ozs.	1000 c.c.s.

In the above formula the sulphite should be first dissolved in part of the water, and enough citric acid added to redden litmus paper and then the pyro added and the total bulk made up by the addition of water. The sulphite may be replaced by 1 oz. (100 gms.) of potassium metabisulphite.

A normal pyro soda developer consists of—

Pyro	2–4 grs.	4.5–9 gms.
Sodium carbonate	20 ,,	45 ,,
Water to...	1 oz.	1000 c.c.s.

and is made by taking A, 20 to 40 minims; B, ½ oz.; water to 1 oz. With 5 minims 10 % potass bromide solution if necessary.

The Hurter & Driffield standard pyro soda developer for plate-speed testing is—

Pyro	8 parts
Sodium carbonate	40 ,,
Sodium sulphite	40 ,,
Water to	1000 ,,

PYRO-METOL

A. Pyro	80 grs.	9.2 gms.
Metol	70 ,,	8 ,,
Potass metabisulphite ...	180 ,,	20.0 ,,
Potass bromide	30 ,,	3.5 ,,
Water to...	20 ozs.	1000 c.c.s.
B. Soda carbonate	3 ozs.	150 gms.
Water to...	20 ,,	1000 c.c.s.

For normal exposures, use equal parts. For under-exposures, increase the proportion of B and add water.

PYRO-CAUSTIC SODA.

(VALENTA.)

A. Pyro	220 grs.	25 gms.
Soda sulphite	$3\frac{1}{4}$ ozs.	162.5 ,,
Water to...	20 ,,	1000 c.c.s.
B. Caustic potash	100 grs.	11.5 gms.
or		
Caustic soda	70 grs.	8.5 gms.
Water to...	20 ozs.	1000 c.c.s.

Take A, 1 oz.; B, 1 oz.; water, 1 oz.

The above is a quick-acting and cheap developer, resembling metol in its characteristics.

RODINAL.

Rodinal is a concentrated liquid preparation of para-amido phenol, sold also in solid form. The following are instructions for the use of the liquid :—

For general work, development of negatives :—Rodinal, 1 oz.; water, 25 ozs. A stronger solution, *e.g.*, Rodinal, 1 oz.; water, 10 ozs., can be used to give density in a shorter time.

For over-exposures :—Rodinal, 1 oz.; water 10 to 15 ozs., with potassium bromide.

For under-exposures :—Rodinal, 1 oz.; water, 30, 40, or 80 ozs.

STAND DEVELOPMENT.

Glycin is a very suitable developer for this purpose, and the following directions are given by Hübl for the use of the formula (given on another page) for a concentrated solution.

Normal developer :—Stock sol., 1 oz.; water, 80 to 90 ozs.; potass bromide, 10% sol., 80 minims.

In this solution a properly exposed plate should make its appearance in 15 or 20 minutes, and obtain full density in several hours.

For under-exposures :—Stock sol., 1 oz.; caustic soda sol. (10%), 1 oz.; water, 50 oz,, warmed to 75 degrees F.

For over-exposures :—Stock sol., 1 oz.; potass bromide, 10% sol. 1 oz.; water, 25 ozs.

TIME DEVELOPMENT.

The following "Watkins' factors" are abstracted from the instructions for the "Watkins' dark room clock and factorial calculator" :—

SUGGESTED FACTORS.

	Grs. pyro to oz.	Factor.
Pyro-soda or pyro-potash without bromide	1	18
	2	12
	3	10
	4	8
	5	6½

	Grs. pyro to oz.	Grs. brom. to oz.	Factor.
Pyro-soda or pyro-potash with bromide	1	¼	9
	2	½	5
	3	¾	4½
	4	1	4
	8	2	3¼

Pyro-acetone about double the above figures.

	Factor.		Factor
Adurol (Schering or Hauff)	5	Diogen	12
Kachin...	10	Edinol	20
Pyrocatechine	10	Diamidophenol	60
Hydroquinone (usual amount of bromide)...	5	Metol-hydroquinone ...	14
Eikonogen	9	Ilford pyro-soda (maximum pyro)	$4\frac{1}{2}$
Metol	30	Ilford pyro-soda (minimum pyro)	$5\frac{1}{2}$
Quinomet	30	Imperial pyro-soda... ...	$4\frac{3}{4}$
Glycine	7	Imperial standard (pyro-metol)	9
Amidol (2 grs. per oz.) ...	18	Kodak powders	18
Rodinal	40	Cristoid developer and film	30
Ortol	10		
Imogen sulphite	6		

Pyro-soda Developers.

(With and without bromide.)

	Factor.		Factor.
Austin-Edwards (with B)...	5	Gem (with B)	4
Cadett (no B)	9	Marion (with B)	$4\frac{1}{2}$
Kodak (no B)	12	Mawson (no B)	10
Edwards (with B)	$4\frac{1}{2}$	Paget (no B)...	11
Elliott (no B)	16	Thomas (with B)	5
Premier (with B)	$4\frac{1}{2}$	Wratten (no B)	11

COMBINED DEVELOPMENT AND FIXING.

Although there is not much to be said for simultaneous development and fixing on practical grounds, the following formula may be given as one of the best for the purpose :—

A.	Kachin	150 grs.	17 gms.
	Sodium sulphite	3 ozs.	150 ,,
	Water to...	20 ,,	1000 c.c.s.
B.	Caustic soda	160 grs.	18 gms.
	Water to...	20 ozs.	1000 c.c.s.
C.	Hypo	1 oz.	560 gms.
	Water to...	2 ozs.	1000 c.c.s.

Take :—A, 160 minims ; B, 24 minims ; C, 20 minims ; water to 1 oz.

General Formula for Developers.

Dr. Lüppo-Cramer gives the following formula—that of the A.G.F.A. for metol—in which the developer proper can be replaced by double the weight of hydroquinone, pyro, adurol, eikonogen, or pyrocatechin :—

A. Developer : soda sulphite, cryst : water = 1 : 10 : 100.
B. Soda carbonate, cryst : water = 1 : 10.
Equal parts of A and B are mixed together.

FIXING, AND HYPO ELIMINATORS.

ACID FIXING BATHS.

Hypo-solution (1 : 5)	50 ozs.	1000 c.c.s,
To which add a mixture of—		
Tartaric acid solution (1 : 2) ...	1½ oz.	30 ,,
Sodium sulphite solution (1 : 4)	3½ ozs.	70 ,,

ALUM-HYPO FIXING BATH.

Alum (saturated solution) ...	20 ozs.	1000 c.c.s.
Sodium sulphite (saturated solution)	4–7 ,,	200–300 ,,
Hypo-solution (1 : 5) ...	20–28 ,,	1000-1250 ,,

CHROME ALUM AND HYPO FIXING BATH.

Add—		
Strong sulphuric acid	1 drachm (fl.)	10 c.c.s.
Water	2 ozs.	80 ,,
to—		
Sodium sulphite	2 ozs.	80 gms.
Water	6 ,,	240 c.c.s.
And pour the mixture into—		
Hypo	16 ozs.	700 gms.
Water	48 ,,	2000 c.c.s.
Finally add to the above mixture—		
Chrome alum	1 oz.	40 gms.
Water	8 ozs.	300 c.c.s.

An excellent acid fixer is made by adding about ½ oz. of potass metabisulphite to each ounce of fixing bath.

To remove the last traces of Hypo from the Film.
Hydroxyl.

Peroxide of hydrogen (20 vols.)	1 drachm	25 c.c.s.
Water	5 ozs.	1000 ,,

After washing the negative well it is immersed for a couple of minutes in the solution and again rinsed in water.

Where peroxide of hydrogen is not obtainable, the following may be used as a substitute :—

Barium dioxide...	1 oz.	25 gms.
Glacial acetic acid	1 ,,	25 ,,
Water	40 ozs.	1000 c.c.s.

Reduce the barium dioxide to a fine powder and add it gradually to the acid and water, shaking until dissolved. A few minutes' immersion in this solution will effectually remove or destroy the last traces of hypo.

Persulphate.

Ammonium persulphate ...	2¼ grs.	5 gms.
Carbonate of soda	5 ,,	10 ,,
Water	1 oz.	1000 c.c.s.

Percarbonate.

Potassium percarbonate ...	2¼ grs.	5 gms.
Water	1 oz.	1000 c.c.s.

HARDENING AND CLEARING SOLUTIONS.

HARDENING BATHS.

Formalin	1 oz. 50 c.c.s. water	10 to 20 ozs. 500 to 1000 c.c.s.
Alum	1 oz. 50 gms. water	20 ozs. 1000 c.c.s.
Chrome alum ...	1 oz. 50 gms. water	20 ozs. 1000 c.c.s.

CLEARING SOLUTIONS.

Acid Alum.

Alum	2 ozs.	200 gms.
Citric acid	1 oz.	100 ,,
Water	10 ozs.	1000 c.c.s.

Wash moderately after fixing, and immerse the negative in the above.

Chrome Alum.

Chrome alum	½ oz.	25 gms.
Hydrochloric acid	½ ,,	25 c.c.s.
or		
Citric acid	1 ,,	50 gms.
Water	20 ozs.	1000 c.c.s.

Thiocarbamide.

Thio carbamide...	90 grs.	10 gms.
Citric acid	90 ,,	10 ,,
Water	20 ozs.	1000 c.c.s.

Sodium Hypochlorite.

Bleaching powder	1 oz.	30 gms.
Sodium carbonate	1½ ,,	45 ,,

Shake up the bleaching powder with a solution of the carbonate in a little water (6 ozs. or 180 c.c.s.), and filter. Extract the residue with plain water and again filter. The filtrate (solution of sodium hypochlorite) forms an active stain remover. It can be acidified with oxalic acid, and then discharges yellow stain still more vigorously, but with risk to the silver image.

Removing Silver Stains.

Soak the negative in—

A.	Potass iodide	200 grs.	45 gms.
	Water	10 ozs.	1000 c.c.s.

And after washing transfer to—

B.	Potass cyanide	300 grs.	70 gms.
	Water	10 ozs.	1000 c.c.s.

in which rub the stained part of the film with a pledget of cotton wool.

If the stain does not yield to this treatment, a solution of iodine (in potass iodide) may be used in place of solution A.

NEGATIVE INTENSIFIERS.

MERCURY INTENSIFICATION.

The negative is bleached in the following saturated solution of mercury bichloride :—

Mercury bichloride (corrosive sublimate)	1 oz.	62 gms.
Hot water	16 ozs.	1000 c.c.s.

After cooling this solution and pouring off from the white feathery crystals thrown down, add—

Hydrochloric acid	30 minims	4 c.c.s.

After well washing the bleached negative is blackened in one or other of the following :—

A.	Ammonia (.880)	20 drops	20 drops
	Water	1 oz.	30 c.c.s.

Gives great intensification and good black colour.

B. Soda sulphite, 10 % solution, made slightly acid with citric acid. Very slightly strengthens a negative.

C. An alkaline developer, such as pyro-soda, pyro-ammonia hydroquinone, or ferrous oxalate. Gives about double the intensification of B.

D.	Schlippe's salt... ...	200–400 grs.	20–40 gms.
	Water	20 ozs.	1000 c.c.s.

This solution must be made fresh and gives great intensification.

MONCKHOVEN'S.

1.	A.	Bromide of potassium... ...	10 grs.	23 gms.
		Bichloride of mercury... ...	10 ,,	23 ,,
		Water	1 oz.	1000 c.c.s.
	B.	Pure cyanide of potassium ...	10 grs.	23 gms.
		Nitrate of silver	10 ,,	23 ,,
		Water	1 oz.	1000 c.c.s.

Place the negative in A till it is white, then rinse and transfer it to solution B. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

LUMIERE'S MERCURIC IODIDE INTENSIFIER.

Composition of Normal Intensifier.

Water	20 ozs.	1000 c.c.s.
Anhydrous sulphite of soda...	2 ,,	100 gms.
Mercuric iodide	90 grs.	10 ,,

Instructions for Use.—Dissolve the anhydrous sulphite of soda in the water, then add the mercuric iodide. After intensification in the above solution, the image is washed and then treated with an alkaline developer, such as used for ordinary negative work ; or a 5 % solution of sodium sulphide answers as well.

TO RESTORE FADED NEGATIVES.

Mr. W. E. Debenham recommends the following solution for the purpose of restoring printing force to negatives which have faded after mercurial intensification :—

Schlippe's salt	10 grs.	23 gms.
Water	1 oz.	1000 c.c.s.

Wet the film thoroughly by soaking in a dish of water, and immerse in the restoring solution until the desired effect is obtained

SILVER INTENSIFIERS.

J. B. B. Wellington's Formula.

Silver nitrate	120 grs.	7.75 gms.
Water	2 ozs.	60 c.c.s.
Add—		
Ammonium sulphocyanide ...	240 grs.	15.5 gms.
Water	3 ozs.	85 c.c.s.

This mixture is best made at the time of use although it may be left for several weeks. To prepare the intensifier, take—

Above mixture	½ oz.	30 c.c.s.
Hypo solution (1 in 4) ...	enough to just dissolve white ppt.	
Pyro (10 % sol.) with sulphite	30 minins	4 c.c.s.
Ammonia (10 % sol.)	40–60 min.	6–8 c.c.s.

Plates should be hardened with alum or formalin, for both this and the following intensifier. When sufficient density is obtained the negative is fixed for a minute or two and washed.

ACID SILVER.

A. Pyro	15 grs.	3.5 gms.
Citric acid	5–10 ,,	1–2 ,,
Water	10 ozs.	1000 c.c.s.
B. Silver nitrate	10 grs.	23 gms.
Water to...	1 oz.	1000 c.c.s.

About 1 oz. (30 c.c.s) of A is poured over the plate, once or twice, about 15 drops of B solution added, and the mixture again applied. Intensification now takes place and the solution is poured off and on until sufficient. If intensifier becomes very thick and turbid, fresh should be mixed up. When dense enough the negative is rinsed, fixed and washed.

COPPER INTENSIFIER.

A.	Copper sulphate	100 grs.	230 gms.
	Water	1 oz.	1000 c.c.s.
B.	Potass bromide	100 grs.	230 gms.
	Water to...	1 oz.	1000 c.c.s.

A and B are separately made up with hot water, mixed and allowed to cool. The negative is bleached in the mixture and washed for a minute or two. It is then blackened in :—

Silver nitrate	45 grs.	100 gms.
Water (distilled)	1 oz.	1000 c.c.s.

For still greater density, the negative is well washed from silver and an ordinary developer applied.

If too dense, after the silver, it can be placed in weak hypo solution (about 10 grs. per oz.) or weak potass cyanide (about 2 grs. per oz.).

LEAD INTENSIFIER.

Lead nitrate	400 grs.	46 gms.
Potass ferricyanide	600 ,,	70 ,,
Acetic acid	3 drachms.	20 c.c.s.
Water to...	20 ozs.	1000 ,,

This stock solution will keep for a long time in the dark. The negative is bleached in it, washed once *very carefully* in 10 % nitric acid—the acid makes the film very tender—then in water, and darkened in :—

A.	Sodium sulphide	1 oz.	50 gms.
	Water	20 ozs.	1000 c.c.s.

Or in—

B.	Schlippe's salt	90 grs.	10 gms.
	Ammonia (.880)...	6 drachms	40 c.c.s.
	Water	20 ozs.	1000 ,,

Or in—

C.	Potass bichromate	1 oz.	100 gms.
	Ammonia (.880)...	½ ,,	50 c.c.s.
	Water	10 ozs.	1000 ,,

The lead intensifier gives very great intensification and is suited only for line subjects.

URANIUM INTENSIFIER.

A.	Uranium nitrate	100 grs.	23 gms.
	Water to...	10 ozs.	1000 c.c.s.
B.	Potass ferricyanide	100 grs.	23 gms.
	Water to...	10 ozs.	1000 c.c.s.

The intensifier is prepared from :—A sol., 1 oz. ; B sol., 1 oz. ; acetic acid, 2 drachms.

After washing very completely from hypo, the negative quickly attains density in the above. It must then be placed in several changes of water to remove all yellow colour. A washer, or grooved tank, should not be employed, as it produces patchiness ; the plates

should soak in still water. If over-intensified, the whole action can be removed in weak solution of sodium carbonate or ammonia, and if the plate is re-intensified it is well to transfer it from this alkaline bath into weak acetic acid for a few moments, rinsing in clean water before re-applying the intensifier.

NEGATIVE REDUCERS.

Farmer's.

Hypo solution (1 : 5)	5 ozs.	150 c.c.s.
Potass ferricyanide (10 % sol.)	quant. suff.	quant suff.

The colour is a fair indication of the strength of the reducer ; it should be pale yellow not orange, and should be used weak rather than strong, since its selective action on the shadows of a negative is then less.

Belitski's.

Potass ferric oxalate	150 grs.	10 gms.
Sodium sulphite	125 ,,	8 ,,
Water	7 ozs.	200 c.c.s.

Dissolve and add—

Oxalic acid	40 to 45 grs.	2.5 to 3.1 gms.

and shake until the solution turns green. Then pour off from any undissolved crystals and add :—

Hypo	$1\frac{3}{4}$ oz.	50 gms.

Instead of the ferric oxalate the following more easily obtainable chemicals can be used in the formula :—

Ferric chloride cryst.	100 grs.	6.5 gms.
Potass oxalate	190 ,,	12.5 ,,

Persulphate.

Ammonium persulphate ...	10 to 20 grs.	23 to 45 gms.
Water	1 oz.	1000 c.c.s.

A fresh solution is made at time of use. When sufficiently reduced —indeed, slightly before—the negative is placed at once into 5 % sodium sulphite solution. If much reduction has taken place it is well to fix a second time.

Eder's (Mercury and Cyanide).

Potassium cyanide	20 grs.	5 gms.
Potassium iodide	10 ,,	2 ,,
Mercury bichloride	10 ,,	2 ,,
Water	10 ozs.	1000 c.c.s.

Reduction takes place slowly and is easy to control.

Dissolve the mercury, then the iodide, and lastly the cyanide to dissolve the red precipitate formed. The solution reduces slowly, but is non-staining.

Iodine-Cyanide.

Iodine (10 % sol. in potass iodide sol.)	30 minims	6 c.c.s.
Potass cyanide (10 % sol. in water	5 ,,	1 c.c.
Water	1 oz.	100 c c.s.

Bichromate.

Potass bichromate	180 grs.	20 gms.
Sulphuric acid	7 drachms (fl.)	40 c.c.s.
Water	20 ozs.	1000 ,,

Eder's Method of Reducing Hard Negatives.

Potass bichromate	90 grs.	10 gms.
Hydrochloric acid	1 oz. (fl.)	30 c.c.s.
Alum	1 ,,	50 gms.
Water	20 ozs.	1000 c.c.s.

The negative is bleached through to the back in this solution, well washed and re-developed in any non-staining developer, such as glycin or rodinal, only up to the right degree of contrast.

NEGATIVE VARNISHES.

No. 1.	Sandarac...	4 ozs.	113 gms.
	Alcohol	28 ,,	800 c.c.s.
	Oil of lavender...	3 ,,	85 ,,

This is a good varnish for retouching upon, as a tooth is easily obtained by rubbing.

No. 2.	White hard varnish	15 ozs.	150 c.c.s.
	Rectified spirit (not methylated spirit)	20 to 30 ,,	200 to 300 c.c.s.

This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off. Very suitable for enlarged negatives that are not to be retained.

Tough, hard, and durable:—

No. 3.	Bleached shellac	1¼ oz.	62 gms.
	Mastic	¼ ,,	13 ,,
	Oil of turpentine	¼ ,,	13 c.c.s.
	Sandarac...	1¼ ,,	62 gms.
	Alcohol	20 ozs. (fl.)	1000 c.c.s.
No. 4.	Sandarac...	80 ozs.	160 gms.
	Turpentine	36 ,,	72 c.c s.
	Oil of lavender...	10 ,,	20 ,,
	Alcohol	500 ,,	1000 ,,

This one may be rubbed down with powdered resin, and gives a splendid surface for retouching :—

No. 5.	Sandarac...	1 oz.	55 gms.
	Seed lac	$1\frac{1}{2}$,,	83 ,,
	Castor oil	3 drachms	20 c.c.s.
	Oil of lavender...	$1\frac{1}{2}$,,	10 ,,
	Alcohol	18 ozs. (fl.)	1000 ,,

This varnish is somewhat dark in colour.

No. 6.	Best orange shellac	$2\frac{1}{2}$ ozs.	125 gms.
	Oil of lavender or oil of turpentine...	$\frac{1}{4}$ oz.	13 c.c.s.
	Methylated alcohol	20 ozs.	1000 ,,

Keep in a warm place until dissolved ; then add a large teaspoonful of whiting or prepared chalk ; shake, set aside to clear, and then decant. This is specially recommended for gelatine negatives.

COLD VARNISHES.

No. 7.	Celluloid...	5 grs.	10 gms.
	Amyl acetate	1 oz.	1000 c.c.s.

This may be flowed over or applied with a brush to the negative and requires no heat.

No. 8.	Zanzibar copal	6 ozs.	30 gms.
	Amber (fused)	1 oz.	5 ,,
	Ether	60 ozs.	300 c.c.s.
	Acetone	40 ,,	200 ,,
	Chloroform	4 ,,	20 ,,

No. 9. A good cold varnish is made from equal parts of gold size and benzole. It dries within about 30 minutes and with a surface on which retouching can be well done.

No. 10.	20 % shellac solution ...	2 ozs.	160 c.c.s.
	Ammonia (.880)...	3 drachms	30 ,,
	Methylated spirit	4 ozs.	320 ,,

SHELLAC WATER VARNISH.

Shellac	3 ozs.	100 gms.
Sodium carbonate (saturated solution)	24 ,,	800 c.c.s.

The shellac is allowed to soak in the liquid for 24 hours, the liquor is then poured away and replaced by an equal quantity of water, and the mixture boiled until the shellac dissolves. After standing some time the liquid becomes perfectly clear and bright.

FILM VARNISHES.

The above water varnish is suitable, or the following :—

Borax	300 grs.	30 gms.
Glycerine...	300 minims	30 c.c.s.
Shellac	600 grs.	60 gms.
Water	20 ozs.	1000 c.c.s.

Boil together for about half an hour, then add—

Methylated spirit	5 ozs.	250 c.c.s.

and filter.

Another good varnish for celluloid films is :—

Dammar	500 grs.	115 gms.
Benzole	10 ozs.	1000 c.c.s.

in which, after filtration, the films are immersed and then hung up to dry.

Celluloid in amyl acetate (No. 7. above) can also be used and is an excellent varnish for films

Retouching Varnish.

1.	Sandarac...	1 oz.	167 gms.
	Castor oil	80 grs.	30 ,,
	Alcohol	6 ozs.	1000 c.c.s.

First dissolve the sandarac in the alcohol, and then add the oil.

In the above formula the proportions of alcohol must be taken as approximate, as different samples of resins vary, some giving more viscous solutions than others.

2.	Pale resin	1 oz.	30 gms.
	Oil of turpentine	1 ,,	30 c.c.s.
	Oil of lavender	2 ozs.	60 ,,

Ground-glass Varnish.

Sandarac...	90 grs.	103 gms.
Mastic	20 ,,	23 ,,
Ether	2 ozs.	1000 c.c.s.

Dissolve the resins in the ether and afterwards add—

Benzole	½–1½ ozs.	250–750 c.c.s.

The proportion of the benzole added determines the nature of the matt obtained.

STRIPPING THE FILM FROM GLASS AND CELLULOID NEGATIVES.

FOR GLASS NEGATIVES.

Soak the negative for ten minutes in a 10 per cent. solution of formaline, then rinse and immerse in—

Water	1 oz.	500 c.c.s.
Methylated spirit	1 ,,	500 ,,
Glycerine	20 minims	20 ,,
Hydrofluoric acid	40 ,,	40 ,,

till the film lifts at the corners, then strip from the glass and wash. This solution does not cause the film to enlarge.

FOR FILM NEGATIVES.

Caustic soda	10 grs.	23 gms.
Formaline	10 minims	20 c.c.s.
Water	1 oz.	1000 ,,

The celluloid negative is immersed in this solution until the film shows signs of detachment and can be rolled back with the finger. It is then placed in

Hydrochloric acid	25 minims	50 c.c.s.
Glycerine	25 ,,	50 ,,
Water	1 oz.	1000 ,,

in which it is removed from its original support to a glass or other base.

ORTHOCHROMATIC PROCESSES.

(For gelatine plates.)

Sensitisers for Blue-Green and Green.

Chrysaniline (sat. sol. in hot alcohol)	10 minims	2 c.c.s.
Distilled water	1 oz.	100 ,,

This reduces the sensitiveness slightly to blue-violet and ultra violet, but sensitises close up to the D line through the green and greenish blue. Time of bathing, 2 to 3 minutes.

Acridine yellow (sat. sol. in hot alcohol)	150—250 minims	30—50 c.c.s.
Distilled water	1 oz.	100 ,,

This gives greater sensitiveness, which extends from D ½ E to ultra-violet. Unfortunately the gelatine is rather deeply stained, and this can only be removed by alcohol.

Accridine orange N O (Leonhardt's) and benzoflavin II. (Oehler's) also sensitise well, the former up to D, the latter to E only.

Sensitisers for Greenish Yellow and Yellow.

PRELIMINARY BATH.

Ammonia	10 minims	2 c.c.s.
Distilled water	1 oz.	100 ,,

Bathe the plate in this for 2 minutes, then immerse for the same time in—

Erythrosine solution (1: 500)...	30 minims	6 c.c.s.
Ammonia	10 ,,	2 ,,
Water	1 oz.	100 ,,

and dry in the dark. Erythrosine is the best sensitiser for these colours. Naphthofluorescine (Bayer) is also useful, and does not lower the blue sensitiveness so much as erythrosine; a deeper coloured yellow screen is therefore required in practice. A preliminary bath is used as for erythrosine, and the sensitising bath is

Naphthofluorescine (1: 500) ...	60 minims	12 c.c.s.
Ammonia	10 ,,	2 ,,
Distilled water	1 oz.	100 ,,

Bathe for 2 minutes and dry in the dark.

Pinaverdol, one of the new isocyanines, is an excellent sensitiser for bluish green, green and yellow; the method of using it is as follows:—

STOCK SOLUTION.

Pinaverdol	9 grs.	1 gm.
Warm alcohol	12 ozs.	600 c.c.s.
Distilled water	8 ,,	400 ,,

SENSITISING BATH.

Stock dye solution	1 oz.	20 c.c.s.
Liq. ammonia	½ ,,	10 ,,
Distilled water to	50 ozs.	1000 ,,

Time of bathing 3 minutes, then wash for 2 or 3 minutes and dry in the dark.

Panchromatic Sensitisers.

(For gelatine plates).

The introduction of the new isocyanines has completely revolutionised the methods of sensitising for orange and red, and such is their action that they produce almost a closed band throughout the spectrum. The method of using them is in all cases the same, and either ethyl red, homocol, pinaverdol, pinachrome or the latest pinacyanol and dicyanine confer the strongest red sensitiveness.

STOCK DYE SOLUTION.

Dye	9 grs.	1 gm.
Warm alcohol	2 ozs.	100 c.c.s.

Dissolve and add—

Alcohol	10 ozs.	500 c.c.s.
Distilled water	8 ,,	400 ,,

This will keep in the dark indefinitely.

THE SENSITISING BATH.

Stock dye solution	1 oz.	20 c.c.s.
Liq. ammonia	½ ,,	10 ,,
Water to	50 ozs.	1000 ,,

Time of immersion 3 to 4 minutes, and then wash in water for 2 to 3 minutes.

The use of ammonia in the sensitising bath frequently causes fog andne cessitates the use of certain plates only, and very rapid drying. If the a mmonia be omitted, almost any clean-working plate may be used, and it is not so essential to dry rapidly. The sensitiveness to green is the same as when ammonia is used, but the red-sensitiveness is one-fifth less.

Sensitisers for Collodion Emulsion.

FOR GREEN AND GREENISH YELLOW (Hübl).

Pinaverdol (1: 500)	1 oz.	40 c.c.s.
Collodion emulsion	25 ozs.	1000 ,,

The sensitiveness extends from the orange to the violet.

PANCHROMATIC SENSITISERS (Hübl).

Pinaverdol (1: 500)	3 oz.	30 c.c.s.
Ethyl violet (1: 500)	½ ,,	5 ,,
Collodion emulsion	100 ozs.	1000 ,,

FOR BLUE AND (SLIGHTLY) BLUE-GREEN SENSITIVENESS.

The following sensitiser increases the sensitiveness of the collodion for ordinary work :—

Canary II. (sat. sol.) (Reade Holliday, Huddersfield) ...	1 oz.	10 c.c.s.
Emulsion...	10 ozs.	100 ,,

The dyed emulsion keeps well, and in half-tone work gives a sharp clean dot.

Safe-lights for Developing.

(Newton & Bull.)

Yellow safe light for wet plates, bromide papers.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Or brilliant yellow	.5 mgm.	$\frac{1}{20}$
Naphthol yellow	1 ,,	$\frac{1}{10}$
Auramine	2 ,,	$\frac{1}{5}$

Red safelight for ordinary plates.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Rose bengal (or fast red) ...	.5 ,,	$\frac{1}{20}$

Safe-light for Ortho plates.

The above screen is combined with one containing—

Methyl violet	.5 mgm.	$\frac{1}{20}$

The red screen transmits light from the end of the visible red about λ 7,000 to λ5,900 in the yellow. The methyl violet absorbs from λ 6,500 to λ 5,000, so that the only light passing the two is the extreme red of λ 7,000 to λ 6,500, to which even the best panchromatic plates are feebly sensitive.

The dyes are dissolved in gelatine solution which in winter should be about 8 per cent. in strength and about 10 per cent. in summer. About 20 c c.s. should be allowed for every 100 sq. cm. of glass, *i.e.*, about 20 minims per sq. in. The dyes are added, most conveniently from stock solutions, in quantity to give the proportions stated above in the filters.

WET COLLODION AND COLLODION EMULSION.

WET COLLODION (for Negatives).

PYROXYLINE (Hardwich).

Sulphuric acid, 1.845	18 ozs. (fl.)	600 c.c.s.
Nitric acid, 1.457	6 ,, ,,	200 ,,
Water	5–5¼ ,, ,,	167-182 ,,
Cotton-wool	300 grs.	23 gms.

Temperature 150 degrees F. (65 degrees C.) Time of immersion, 10 minutes.

Iodised Collodion.

For Acid Pyro Developer.

Ether, s.g. .725	10 ozs. (fl.)	1000 c.c.s.
Alcohol, s.g. .805	4 ,, ,,	400 ,,
Pyroxyline	120 grs.	27 gms.
Iodide of ammonium	30 ,,	7 ,,
,, cadmium	45 ,,	10 ,,
Alcohol (.830)	4 ozs. (fl.)	400 c.c.s

Bromo-iodised Collodion.

Iron Developer.

Ether, s.g. .725	10 ozs. (fl.)	1000 c.c.s.
Alcohol, s.g. .805	5 ,, ,,	500 ,,
Pyroxyline	120 grs.	27 gms.
Iodide of ammonium	40 ,,	9 ,,
,, cadmium	40 ,,	9 ,,
Bromide of ,, ...	20 ,,	4.5 ,,
Alcohol (.830)	5 ozs. (fl.)	500 c.c.s.

The Nitrate Bath.

Nitrate of silver (recrystallised)	6 ozs.	75 gms.
Distilled water	80 ,, (fl.)	1000 c.c.s.
Nitric acid (pure)	8 minims	0.2 ,,

Saturate with iodide of silver, which may be done by coating a plate with collodion and leaving it in the bath for some hours. Filter

Developer.

No. 1.	Ferrous sulphate	½ oz.	50 gms.
	Glacial acetic acid	½ ,,	50 c.c.s.
	Alcohol	½ ,,	50 ,,
	Water	10 ozs.	1000 ,,
No. 2.	Ammonio-sulphate of iron ...	75 grs.	43 gms.
	Glacial acetic acid	75 ,,	43 ,,
	Sulphate of copper	7 ,,	4 ,,
	Water	4 ozs.	1000 c.c.s.
	Alcohol	¼ oz.	60 ,,

POSITIVES AND FERROTYPES BY WET COLLODION.

Bromo-iodised Collodion.

Ether, s.g. .725	10 ozs. (fl.)	1000 c.c.s.
Alcohol, s.g. 805	5 ,, ,,	500 ,,
Pyroxyline	100 grs.	23 gms.
Iodide of cadmium	50 ,,	11½ ,,
Bromide of ammonium ...	25 ,,	5.7 ,,
Alcohol, .830	5 ozs. (fl.)	500 c.c.s.

Note.—The iodides should be dissolved in the weaker spirit and the pyroxyline in the ether and stronger spirit, and the two solutions mixed.

Silver Bath.

Nitrate of silver (recrystallised)	5½ ozs,		70 gms.
Distilled water	80 ,,	(fl.)	1000 c.c s.
Nitric acid (pure)	½ drachm		0.8 ,,

Saturate with iodide of silver and filter as above.

Developers.

Ferrous sulphate	150 grs.	34 gms.
Glacial acetic acid	½ oz.	50 c.c.s.
Nitric acid	5 minims	1 ,,
Alcohol	½ oz.	50 ,,
Water	10 ozs.	1000 ,,

Note.—By increasing the proportion of nitric acid and decreasing that of the acetic, the image will be more metallic in appearance.

Nitrate of Iron Developer.

Ferrous sulphate	1½ oz.	75 gms.
Nitrate of baryta	1 ,,	50 ,,
Water	20 ozs.	1000 c.c.s.
Alcohol	1 oz.	50 ,,
Nitric acid	40 drops	4 ,,

The insoluble sulphate of baryta which is formed must be filtered out.

Fixing Solution.

Cyanide of potassium... ...	½ oz.	25–30 gms.
Water	15–20 ozs.	1000 c.c.s.

Developer for Collodion Transfers.

Pyrogallic acid	4 gms.	11 gms.
Citric acid	3 ,,	7 ,,
Acetic acid	20 minims	41 c.c.s.
Water	1 oz.	1000 ,,
Alcohol	20 minims	41 ,,

WET COLLODION FOR HALF-TONE.

Eder's Formulæ.

Cadmium iodide	108 grs.	7 gms.
Ammonium iodide	50 ,,	3.2 ,,
Ammonium bromide	18½ ,,	1.2 ,,
Alcohol	6 ozs,	170 c.c.s.
Raw collodion 2 %	18 ,,	511 ,,

Or equal parts of above and—

Strontium iodide	154 grs.	10 gms.
Cadmium bromide	68 ,,	1.8 ,,
Alcohol	7 ozs.	200 c.c.s.
Collodion 2 %	21 ,,	600 ,,

The developer specially recommended for above is—

Sulphate of iron	288 grs.	30 gms.
Sulphate of copper	192 ,,	16 ,,
Glacial acetic acid	1 oz.	50 c.c.s.
Alcohol	½ ,,	30 ,,
Water	20 ozs.	1000 ,,

COLLODION EMULSION.

Pyroxyline for Collodio-bromide or Unwashed Emulsion.

Nitric acid, s.g. 1.45	2 ozs. (fl.)	285 c.c.s.
Sulphuric acid, s.g. 1.845 ...	4 ,,	570 ,,
Water	1 oz. (fl.)	145 ,,
Cotton (cleaned and carded)...	100 grs.	33 gms.

Temperature, 150 degrees F. (65 degrees C.). Time of immersion 10 minutes.

For Washed Emulsion.

Nitric acid, s.g. 1.45	2 ozs. (fl.)	400 c.c.s.
Sulphuric acid, s.g. 1.845 ...	3 ,,	600 ,,
White blotting-paper	145 grs.	66 gms.

Temperature, 100 degrees F. (38 degrees C.). Time of immersion 30 minutes.

Collodio-bromide Emulsion.

Ether, s.g. .720	5 ozs. (fl.)	620 c.c.s.
Alcohol, s.g. .820	3 ,,	380 ,,
Pyroxyline	50 grs.	14.3 gms.
Bromide of cadmium and ammonium	80 ,,	23 ,,
or		
Bromide of zinc...	76 ,,	21.5 ,,

Sensitise by adding to each ounce 15 grs. of nitrate of silver dissolved in a few drops of water and 1 drachm of boiling alcohol. This is suitable for slow landscape work or for transparencies.

For Washed Emulsion (for Transparencies).

Ether, s.g. .720	5 ozs. (fl.)	620 c.c.s.
Alcohol, s.g. .820	3 ,,	380 ,,
Pyroxyline or papyroxyline...	60 grs.	17 gms.
Bromide of cadmium and ammonium	100 ,,	29 ,,
or		
Bromide of zinc...	96 ,,	27.5 ,,
Hydrochloric acid (s.g. 1.2) ...	8 minims	2 c.c.s.

Sensitise with 20 grs. of nitrate of silver to each ounce (4.3 grs. to each 100 c.c.s.), dissolved in a minimum of water with 2 drachms (13 c.c.s.) of boiling alcohol. Allow to stand for two or three days.

N.B.—In the last formulæ the emulsion, after being allowed to ripen for the time stated, should be poured into a dish and allowed to

become thoroughly dry. The mass of dry emulsion is then washed to remove all the soluble salts, and is then again dried and re-dissolved in equal parts of ether and alcohol, at the rate of from 20 to 24 grs. to the ounce of solvents.

Wellington's Collodio-bromide Emulsion Formulæ.

Pyroxyline	30 grs.	23 gms.
Ether	12 drachms	500 c.c.s.
Alcohol	12 ,,	500 ,,

To bromise, add 30 grs. (33 gms.) bromide ammonium dissolved in 45 minims (31 c.c.s.) water, to which 4 drachms (170 c.c.s.) of alcohol are afterwards added; 50 grs. (33 gms.) of nitrate of silver dissolved in a drachm (4½ c.c.s.) of water are then added. After washing and drying, the pellicle is dissolved in 1¾ oz. (58 c.c.s) of ether and the same of alcohol.

Developer.

An excellent developer for collodion emulsion is the following, worked out by the Bolt Court School of Photo-Engraving, London :—

Glycin	1 oz.	10 gms.
Sodium sulphite	2½ ozs.	25 ,,
Potass carbonate	5 ,,	50 ,,
Potass bromide	30 grs.	.7 gm.
Water to	30 ozs.	300 c.c.s.

Intensifying Solution for Collodion Emulsion.

Nitrate of silver	60 grs.	70 gms.
Citric acid	30 ,,	35 ,,
Nitric acid	30 minims	35 c.c.s.
Water	2 ozs.	1000 ,,

To each drachm of a three-grain solution of pyrogallic acid add 2 or 3 minims of the above, and apply until sufficient density is attained.

PLAIN AND ALBUMEN PAPERS.

PLAIN PAPER.

Prepare the plain paper with—

Ammonium chloride ...	60–80 grs.	14–18 gms.
Sodium citrate	... 100 ,,	23 ,,
Sodium chloride ...	20–30 ,,	4.5–7 ,,
Gelatine	... 10 ,,	2 ,,
Distilled water	... 10 ozs.	1000 c.c.s.

or—

Ammonium chloride ...	... 100 grs.	23 gms.
Gelatine	... 10 ,,	2 ,,
Water	... 10 ozs.	1000 c.c.s.

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added. The solution is filtered, and, when still warm, the paper floated upon it for three minutes.

The salted paper is sensitised upon a neutral 45-grain silver bath.

Platinum Toning Bath.

Chloroplatinite of potassium	4.5 grs.	1 gm.
Water	10 ozs.	1000 c.c.s.
Nitric acid	2–3 drops	5–10 drops

ALBUMEN PAPER.

Silver Bath.

Silver nitrate	600 grs.	140 gms.
Distilled water	10 ozs.	1000 c.c.s.

The bath is made just acid with nitric acid, requiring three or four drops per 10 ozs.

Toning Baths.

No. 1.	Chloride of gold	1 gr.	0.3 gm.
	Acetate of soda	30 grs.	6 gms.
	Water	8 ozs.	1000 c.c.s.

This must not be used till one day after preparation. It keeps well and gives warm, rich tones.

No. 2.	Gold chloride	15 grs.	1 gm.
	Water	4 ozs.	120 c.c.s.

Add lime water until a piece of red litmus paper, placed in the solution, is turned blue. Then add—

Calcium chloride, fused ..	120 grs.	7.7 gms.
Water to make...	$7\frac{1}{2}$ ozs.	115 c.c.s.

This solution is diluted with 15 times its volume of water to make the toning bath; it can be used over and over again by additiou of stock solution.

To Prevent Blisters in Albumen Prints.

Before wetting the prints immerse them in methylated spirit, then wash and tone as usual.

Preservative for Sensitised Albumen Paper.

Sensitise the paper in the usual bath, drain well, and when superficially dry float the back of the paper for twenty minutes on a solution of—

Citric acid	1 oz.	33 gms.
Water	30 ozs.	1000 c.c.s.

GELATINE P.O.P.

FORMULÆ FOR PRINTING-OUT EMULSIONS.

BARKER'S.

Gelatine (Nelson's No. 1 and Coignet's, equal parts) ...	175 grs.	80 gms.
Ammonium chloride	18 ,,	8 ,,
Rochelle salts	50 ,,	23 ,,
Silver nitrate	75 ,,	34 ,,
Alcohol	4 drachms	160 c.c.s.
Water	5 ozs.	1000 ,,

Heat to 100 degrees F. (38 degrees C.), and allow to remain at this temperature after all is dissolved for ten minutes, after which proceed in the usual way.

VALENTA'S.

A.	Silver nitrate	480 grs.	32 gms.
	Citric acid	120 ,,	8 ,,
	Hot water	$5\frac{1}{4}$ ozs.	160 c.c.s.
B.	Gelatine	1440 grs.	96 gms.
	Ammonium chloride	42 ,,	2.8 ,,
	Water	24.3 ozs.	700 ,,
C.	Tartaric acid	42 grs.	2.8 ,,
	Sodium bicarbonate	21 ,,	1.4 gm.
	Alum	27 ,,	1.8 ,,
	Water	5 ozs.	140 c.c.s.

Allow the gelatine to swell in the water and melt by the aid of heat, and add the chloride. Mix B and C at 50 degrees C., and in yellow light add A, heated to the same temperature, in small quantities, shaking thoroughly, and allow the emulsion to ripen for a short time at from 40 degrees to 50 degrees C. and then filter. For matt surface papers the gelatine should be reduced to 754 grs. or 80 gms.

The above formula gives vigorous brilliant prints, but for soft negatives a harder printing emulsion is obtained by adding from 0.05 to 0.1 per cent. of calcium bichromate solution ; this can be made by dissolving 480 grs. or 25 gms. of pure chromic acid in 4 ozs. or 100 c.c.s. of distilled water, and adding sufficient pure chalk (calcium carbonate) to make the solution cloudy. The solution should then be filtered, and the filter washed with distilled water up to 4 ozs. or 100 c.c.s.

BEADLE'S.

Nelson's gelatine	340 grs.	112 gm.
Alum	15.5 ,,	5 gms.
Water	$6\frac{1}{4}$ ozs.	900 c.c.s.
Rochelle salt	15.5 grs.	5 gms.
Ammonium chloride	11 ,,	3.5 ,,

Heat to 50 degrees C., and add—

Silver nitrate	115 grs.	37.5 gms.
Citric acid	62 ,,	20 ,,
Water	1 oz.	100 c.c.s.

GOLD TONING BATHS.

Sulphocyanide.

Gold chloride	2½ grs.	.3 gms.
Ammonium sulpoocyanide ...	30 ,,	3.5 ,,
Water	20 ozs.	1000 c.c.s.

It is necessary for this and all sulphocyanide baths to ripen. The best method of mixing is to boil the water and to dissolve the gold in one half and the sulphocyanide in the other. Then pour the former into the latter, stirring all the time, and use when cool. If cold water is used, the mixture should be allowed to stand 12 hours.

Formate.

Gold chloride	1 gr.	.12 gm.
Sodium bicarbonate	2 grs.	.23 gms.
Sodium formate	8 ,,	.9 ,,
Water	20 ozs.	1000 c.c.s.

The prints must be immersed in a 10 °/₀ solution of salt and water before using this bath.

Tungstate.

Sodium tungsate	30 grs.	3.5 gm.
Sodium carbonate	1 gr.	.12 ,,
Gold chloride	1 ,,	.12 ,,
Water	10–20 oz.	500–1000 c.c.s.

Concentrated Sulphocyanide.

(Bühler's Formula.)

A.	Distilled water	1 oz.	150 c.c.s.
	Gold chloride	15 grs.	5 gms.
B.	Strontium chloride	150 ,,	50 ,,
	Distilled water	¾ oz.	100 c.c.s.
C.	Potassium sulphocyanide	80–150 grs.	25–50 gms.
	Distilled water	1¾ oz.	250 c.c.s.

Heat B to boiling, and add A (heated to 100 degrees F.) in small doses. Bring C to boiling, and allow to cool to 205 degrees F., and add the hot mixture of A and B in four or five lots with constant stirring; cool and filter. If a precipitate forms, re-heat to nearly boiling, wash the filter with ¾ oz. (100 c.c.s.) water, and add this latter to the total bulk. The bath is diluted with 10 times its volume of water for use.

Thiocarbamide Bath.

Gold chloride	4 grs.	.25 gm.
Distilled water	1 oz.	25 c.c.s.

Add, to dissolve precipitate first formed, sufficient of :—

Thiocarbamide	90 grs.	1 gm.
Distilled water	10 ozs.	50 c.c.s.

About ½ oz. (14 to 15 c.c.s.) will be needed. Next add :—

Citric acid	8 grs.	.5 gm.

and

Distilled water to	35 ozs.	1000 c.c.s.

and finally

Salt	160 grs.	10 gms.

The prints should be thoroughly washed *before* as well as after fixing.

Short Stop for Gold Toning.

A weak solution of sodium sulphite (5 grs. per oz.) at once arrests the action of a gold toning bath.

SALT BATH.

A short immersion of prints in the following bath prior to the first washing favours even toning and prevents spots and stains from rusty tap water :—

Salt	2 ozs.	100 gms.
Sodium carbonate	1 oz.	50 ,,
Water	20 ozs.	1000 c.c.s

If prints are to be toned in the platinum bath, the carbonate should be omitted.

PLATINUM TONING BATHS.

Phosphoric Acid.

Potass chloroplatinite... ..	4 grs.	.45 gm.
Phosphoric acid (sp. gr. 1.12)...	¾ oz. (fl.)	35 c.c.s.
Water to...	20 ozs.	1000 ,,

Citric Acid.

Potass chloroplatinite... ...	4 grs.	.45 gm.
Sodium chloride (salt)	40 ,,	4.5 gms.
Citric acid	50 ,,	5.8 ,,
Water to	20 oz.	1000 c.c.s.

Haddon's Formula.

Platinum perchloride	3 grs.	.2 gm.
Sodium formate	100 ,,	6.5 gms.
Formic acid	30 minims	1.8 c.c.
Water to...	35 oz.	1000 c.c.s.

Short Stop for Platinum Toning.

A weak solution of sodium carbonate (10 grs. per oz.) instantly arrests the toning action of a platinum bath.

Black Tones.

Valenta's Formula.

Tone in —

Potass chloroplatinite... ...	2½– 0 ,,	.5–2 gms.
Metaphenylenediamine ..	2½–10 ,,	.5–2 ,,
Water	10 ozs.	1000 c.c.s.

having first washed the prints well.

Another method is to print deeply and immerse the prints in :—

Salt	1 oz.	25 gms.
Sodium bicarbonate	80 grs.	9 ,,
Water	20 ozs.	1000 c.c.s.

then wash well and tone in a borax gold bath to a purple red. Again well wash and tone in the phosphoric platinum bath.

VALENTA'S BATH FOR RED TONES.

Uranium nitrate	10–20 grs.	1–2 gms.
Thiosinamine	90 ,,	10 ,,
Water	20 ozs.	1000 c.c.s.

The prints are well washed, finally in water acidulated with acetic acid, and then toned. They are afterwards fixed, or can be toned to sepia brown in the combined bath.

COMBINED BATHS.

Valenta's.

Hypo	8 ozs.	400 gms.
Ammonium sulphocyanide ...	1 oz.	50 ,,
Lead nitrate	175 grs.	20 ,,
Alum	350 ,,	40 ,,
Water to...	20 ozs.	1000 c.c.s.

Dissolve the hypo in the water, add the sulphocyanide, then add the alum dissolved in a little water, and also the lead, and add to the hypo. Heat the mixture to 120 degrees F. for ten minutes; allow to cool. For use take

Stock solution (as above) ...	10 oz.	100 c.c.s.
Water	10 ,,	100 ,,
Gold chloride (from stock sol.)	3½ grs.	.23 gm.

Alkaline Toning and Fixing Bath.

Gold chloride	2 grs.	.23 gm.
Lead nitrate	10 ,,	1.2 ,,
Chalk	½ oz.	25 gms.
Hypo	4 ozs.	200 ,,
Water	20 ,,	1000 ,,

Shake the solution well, allow to settle and use the clear portion.

REDUCER FOR OVER-PRINTED PROOFS.

A. Ammonium sulphocyanide	10 % sol.
B. Potass ferricyanide	10 % sol.

A, 5 ozs.; B, ½ oz.; water, 24 ozs.

DEVELOPING P.O.P.

Direct Process with Acid Developer.

Hydroquinone	16 grs.	18.5 gms.
Citric acid	40 ,,	4.6 ,,
Sodium acetate	1 oz.	50 ,,
Water	20 ozs.	1000 c.c.s.

Immerse the dry prints in the developer, and after development wash in plenty of water for 10 or 15 minutes, then tone in the usual way.

Paget "Bromide" Process.

The prints are immersed in 10 per cent. potass bromide solution for 5 or 10 minutes, washed and developed with the following :—

A.	Hydroquinone	40 grs.	4.5 gms.
	Sodium sulphite	160 „	18.0 „
	Water to...	20 ozs.	1000 c.c.s.
B.	Potass bromide...	$2\frac{1}{2}$ „	125 gms.
	Sodium carbonate	2 „	100 „
	Water to...	20 ozs.	1000 c.c.s.

For average negatives mix :—A, $\frac{1}{2}$ oz. ; B, 1 oz. ; water, $\frac{1}{2}$ oz.

For flat negatives (greater contrast), A, 3 drachms ; B, 1 oz. ; water, 5 drachms.

For hard negatives (soft results), say, A, 7 drachms ; B, 1 oz. ; water, 1 drachm.

BRUSH TONING.

Very rapid toning can be done with a strong toning bath applied with a brush, and though the method consumes more gold than the usual one there are times when it is conveniently adopted. Toning takes place in about two minutes, and the process yields good rich tones.

Toning Solution.

Ammonium sulphocyanide 10 %, sol.	70 minims	4 c.c.s.
Water to make	5 drachms	18 „

Add little by little in order given—

Gold chloride sol. (1 gr. per drachm)	1 drachm	3.5 c.c.s.
Sodium phosphate (10 % sol.)	30 minims	1.8 „
Borax saturated solution ...	80 „	45 „

From 30 to 45 minims are used per quarter-plate print.

COLLODIO-CHLORIDE P.O.P.

VALENTA'S FORMULA.

1.	Strontium chloride	154 grs.	10 gms.
	Lithium chloride	77 ,,	5 ,,
	Water	500 minims	30 c.c.s.
	Alcohol (absolute)	930 ,,	55 ,,
2	Silver nitrate	400 grs.	20 gms.
	Water	500 minims	30 c.c.s.
	Alcohol	1000 ,,	60 ,,
3.	Citric acid	77 grs.	5 gms.
	Alcohol	675 minims	40 c.c.s.
	Glycerine	92 grs.	6 gms.

In a bottle capable of holding 1000 parts pour 350 parts of 3 per cent. collodion and add gradually 15 parts of No. I, then in the dark room add almost drop by drop 60 parts of No. 2, shaking well after each addition ; then add 50 parts of No. 3, and 50 parts of ether. This collodion is suitable for normal negatives, but more contrast can be obtained if 0.1 to 0.4 per cent. calcium chromate solution is added. By reducing the amount of pyroxyline in the above formula the emulsion is more suitable for matt surface paper.

GOLD-PLATINUM TONING.

Gold Bath.

Gold chloride	½ gr.	.06 gm.
Sodium acetate	20 grs.	4.6 gms.
Water to	20 ozs.	1000 c.c.s.

Platinum Bath.

Potass chloroplatinite	½ gr.	.06 gm.
Phosphoric acid...	2¼ ozs.	110 c.c.s.
Water to...	20 ,,	1000 ,,

For black tones, the prints are first toned in the gold bath (for a longer or shorter time according as a more or less black tone is desired), washed in three changes of water and completed in the platinum bath.

BROMIDE AND GASLIGHT PAPERS.

Developers.

AMIDOL.

Sodium sulphite	650 grs.	74 gms.
Potassium bromide	10 ,,	1.2 gm.
Water	20 ozs.	1000 c.c.s.

When dissolved add—

Amidol	50 grs.	5.7 gms

This developer will not keep more than three days.

The most convenient and economical method of using amidol developer for bromide papers is to make up a 10 per cent. stock solution of sodium sulphite and add 5 grs. potassium bromide to each 10 ozs. solution. For use add 4 grains dry amidol to each ounce stock solution, and dilute with an equal bulk of water

METOL.

A.	Metol	100 grs.	11.5 gms.
	Sodium sulphite	2 ozs.	100 ,,
	Potassium bromide	12 grs.	1.4 gm.
	Water	20 ozs	1000 c.c.s.
B.	Potassium carbonate	2 ,,	100 gms.
	Water	20 ,,	1000 c.c.s.

For use take 3 ozs. of A and 1 oz. of B.

For gaslight papers use half the quantity of water in above formula.

METOL HYDROQUINONE.

Metol	8 grs.	1 gm.
Hydroquinone	30 ,,	3.5 gms.
Sodium sulphite	¾ oz.	37.5 ,,
Sodium carbonate	¾ ,,	37.5 ,,
10 % solution of potassium bromide	20 minims	2.5 c.c.s.
Water	20 ozs.	1000 c.c.s.

For gaslight papers make up above formula with 10 ozs. of water.

RODINAL.

Rodinal	100—150 minims	6—9 c.c.s.
Water	10 ozs.	300 ,,
10 % solution of potassium bromide	20 minims	1 c.c.

ORTOL.

A.	Ortol	120 grs.	14 gms.
	Potassium metabisulphite ...	60 ,,	7 ,,
	Water	20 ozs.	1000 c.c.s.
B.	Sodium sulphite	4 ozs.	200 gms.
	Potassium carbonate	1 oz.	100 ,,
	Potassium bromide	20 grs.	2.3 ,,
	Water	20 ozs.	1000 c.c s.

Use equal parts of A and B.

For gaslight papers use half the quantity of water given in this formula.

FERROUS OXALATE.

A.	Sulphate of iron	5 ozs.	250 gms.
	Sulphuric acid	30 minims	3 c.c.s.
	Warm water to...	20 ozs.	1000 c.c.s.

B.	Neutral oxalate of potassium	5 ,,	250 gms.
	Potassium bromide	10 grs.	1.2 gm.
	Warm water to	20 ozs.	1000 c.c.s.

For use add 1 oz. of A to 4 ozs. of B, not *vice versa*.

After development and without washing, immerse the prints for two minutes in acid bath, pour off and repeat.

ACID BATH.

Glacial acetic acid	1 drachm	6 c.c.s.
Water	20 ozs.	1000 ,,

Then wash thoroughly to remove last trace of acid.

Toning Bromide and Gaslight Prints.

SEPIA AND BROWN TONES.

HYPO-ALUM.

Hot water	20 ozs.	1000 c.c.s.
Hypo	2½ ,,	125 gms.

Dissolve and add—

Alum	½ oz.	25 ,,

This solution should not be filtered and it works better as it becomes older; it may be strengthened from time to time with a little fresh solution.

The best results are obtained by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes. When this toning bath is to be employed, the use of the alum bath after fixing is absolutely essential. Moreover, the prints should not, in this case, be subjected to a prolonged washing, but should only be slightly rinsed before being dried.

A new bath tends to reduce the prints rather more than an old one.

When toned the prints should be placed in a tepid solution of—

Water	70 ozs.	1000 c.c.s.
Alum	2 ,,	30 gms.

and then washed thoroughly.

SULPHIDE TONING.

A.	Ammonium bromide	300 grs.	35 gms.
	Potassium ferricyanide ...	300 ,,	35 ,,
	Water	20 ozs.	1000 c.c.s.
B.	Sodium sulphide (pure) ...	100 grs.	12 gms.
	Water	20 ozs.	1000 c.c.s.

Bleach the fixed and washed print in A solution. Wash for a few minutes in water and then immerse in B solution until toned. The print is then well washed and dried.

Copper Toning.

A.	Copper sulphate	60 grs.	7 gms.
	Potassium citrate (neutral) ...	240 ,,	28 ,,
	Water	20 ozs.	1000 c.c.s.
B.	Potassium ferricyanide ...	50 grs.	6 gms.
	Potassium citrate (neutral) ...	240 ,,	28 ,,
	Water	20 ozs.	1000 c.c.s.

Use equal parts of each. Warm black to red chalk tones are obtained.

Platinum Toning.

(Not for Gaslight Prints).

Potassium chloroplatinite ...	12 grs.	.8 gm.
Mercuric chloride	6 ,,	.4 ,,
Citric acid	54 ,,	3.4 gms.
Water	6 ozs.	170 c.c.s.

This bath should be made up fresh for use from stock solutions. Gives warm sepia tones, with slight staining of high lights. For cold sepia tones and absence of staining add 30 minims 10 per cent. solution potassium bromide to above. Wash well after toning.

Uranium Toning.

A.	Uranium nitrate	90 grs.	10 gms.
	Water	20 ozs.	1000 c.c.s.
B.	Potassium ferricyanide ...	90 grs.	10 gms.
	Water	20 ozs.	1000 c.c.s.

Use equal parts of A and B, and add 20 minims of glacial acetic acid to each ounce of mixture. The prints must be free from hypo. After toning wash in several changes of *still* water till the high-lights are clear. Washing in running water will remove the toning in patches. This bath intensifies the image.

Green Tones.

Vanadium chloride	20 grs.	1 gm.
Ferric chloride	10 ,,	.5 ,,
Ferric oxalate	10 ,,	.5 ,,
Potassium ferricyanide ...	20 ,,	1 ,,
Oxalic acid (sat. sol.) ...	2½ ozs.	60 c.c.s.
Water to...	20 ,,	1000 ,,

Dissolve the vanadium salt in hot hydrochloric acid and a little water. Add the ferric chloride and oxalate to the oxalic acid solution diluted with half the water, then add the ferricyanide dissolved in water, stirring well, and finally the vanadium. Tone till the prints turn blue, and then wash till they are green.

Blue Tones.

10 % solution ferric ammonium citrate	2 ozs.	10 c.c.s.
10 % solution potassium ferricyanide	2 ,,	10 ,,
10 % solution acetic acid ...	20 ,,	100 ,,

The well washed prints are immersed in this bath until the desired tone is given. Then well wash until high lights are clear. This bath intensifies the image.

Gold Toning.

Ammonium sulphocyanide ...	30 grs.	2	gms.
Chloride of gold	2 ,,	.13	gm.
Boiling water	4 ozs.	110	c.c.s.

Use as soon as cool. Place the wet print face upwards on a sheet of glass, squeegee into contact, blot off superfluous moisture, and paint the above bath on with a broad flat brush; when the desired tone is reached wash well and dry. This considerably improves the colour of greenish or rusty black prints, and if allowed to act for some time bluish tones are obtained.

Practically all the above toning solutions can be employed for lantern plates.

Making Line Drawings from Bromide, Gaslight, or P.O.P. Prints.

After outlining the subject in waterproof Indian ink, bleach out the image in—

Thiocarbamide	240 grs.	25 gms.
Nitric acid	4 drams (fl.)	25 c.c.s.
Water	20 ozs.	1000 ,,

Or in—

Iodine sol. (10 % in potass iodide sol.)	30 minims	6 c.c.s.
Potass cyanide (10 % sol. in water)	5 ,,	1 c.c.
Water	1 oz.	100 c.c.s.

The iodine-cyanide solution, weaker if necessary, can be used as a reducer for over-developed bromide or gaslight prints.

THE CARBON PROCESS.

SENSITISING SOLUTIONS.

Potass bichromate	1 oz.	35–50 gms.
Water	20–30 ozs.	1000 c.c.s.
Liquor ammonia (.880) ...	60 minims	6 ,,

A longer immersion in the weaker solution is practically equal to a shorter one in the stronger bath.

If the tissue is squeegeed on a glass plate after sensitising light or heavy squeegeeing also modifies its sensitiveness by removing more or less of the solution. If the tissue be squeegeed on to a ferrotype plate, and allowed to dry upon it, the drying may be done in the light of an ordinary room. The face of the tissue is then protected from light, dust, and injurious vapours.

The following has been recommended :—

B.	Potass bichromate	1 oz.	20 gms.
	Water	50 ozs.	1000 c.c.s.
	Citric acid	¼ oz.	5 gms.

Liquor ammonia q.s. to change the tint of the solution to a lemon yellow. This gives a slower tissue than the above, but is said to keep better.

WAXING SOLUTIONS.

For Carbon Prints, or for Removing Collodion Films.

No. 1.	Beeswax	20 grs.	10 gms.
	Benzole rect. No. 1	4 ozs.	1000 c.c.s.

For Flexible Supports (Autotype.)

No. 2.	Yellow resin	180 grs.	42 gms.
	Yellow beeswax...	60 ,,	14 ,,
	Rectified spirits of turpentine	10 ozs.	1000 c.c.s.

Fixing or Hardening Bath.

Alum	1 oz.	50 gms.
Water (1 pint)	20 ozs.	1000 c.c.s.

GELATINE SOLUTIONS.

For transferring carbon pictures from flexible support to ivory, opal, glass, etc. :—

Nelson's No. 1 gelatine ...	1 oz.	50 gms.
Water	1 pint	1000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) hot water..	12 grs.	1.4 gms.

For coating drawing-papers for the single transfer process :—

Nelson's No. 1 gelatine ...	1 oz.	50 gms.
Water	1 pint	1000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) water ...	20 grs.	2.3 gms.

Apply with a brush.

Note.—In adding a solution of chrome alum to one of gelatine, both solutions should be at a fairly high temperature, 130 degrees to 160 degrees F.

Substratum for Carbon Transparencies.

Nelson's No. 1 gelatine ...	¾ oz.	37 gms.
Water	20 ozs.	1000 c.c.s.
Potass bichromate	12 grs.	1.4 gm.

Well cleaned plates are coated with this and dried, when they are fully exposed to light, which will render the coating insoluble.

To remove Bichromate Stains from the Fingers and Nails after Sensitising.

Apply dilute ammonia to the parts until the stains disappear, then well wash the hands with warm water and soap.

PLATINUM PRINTING.

DEVELOPERS FOR SEPIA TONES.

A.	Potass oxalate	2 oz.	20 gms.
	Water...	15 ozs.	150 c.c.s.
B.	Potass citrate	160 grs.	23 gms.
	Citric acid	250 ,,	39 ,,
	Mercuric chloride	95 ,,	14 ,,
	Water...	15 ozs.	1000 c.c.s.

Equal parts of A and B, used slightly warm. The prints are afterwards fixed in acid baths of one-third the usual strength.

Another Formula.

Prepare the following solutions :—

1.	Potassium oxalate	4 ozs.	250 gms.
	Distilled water	16 ,,	1000 c.c.s.
2.	Cupric chloride...	124 grs.	35 gms.
	Distilled water	8 ozs.	1000 c.c.s.
3.	Mercuric chloride	1 oz.	62 gms.
	Distilled water	16 ozs.	1000 c.c.s.
4.	Lead acetate	32 grs.	18 gms.
	Distilled water	4 ozs.	1000 c.c.s.

Mix 12 parts of No. 1 with 4 parts No. 2, then add 4 parts No. 3 and 1 part No. 4, and heat till the precipitate first formed is redissolved. The solution should be heated to 175 degrees F., and the prints developed in it in the usual way and treated to the usual acid clearing baths, then immersed in ammonia solution (about 10 minims per oz.) for five minutes, and washed and dried.

Intensifier for Platinum Prints.

A.	Sodium formate	45 grs.	100 gms.
	Water	1 oz.	1000 c.c.s.
B.	Platinum perchloride	10 grs.	1 gm.
	Water	1 oz.	45 c.c.s.

Add 15 minims each of A and B to 2 ozs. water (3 c.c.s. to 100 c.c.s.).

Restoring Yellowed Prints.

Shake up bleaching powder with about ten times its weight of water, let the mixture stand a few minutes, and pour off the clear part. To this latter add a little weak hydrochloric acid—enough to give the mixture a faint chlorine smell. The solution removes the yellow (iron) stain from platinum prints.

FERRO-PRUSSIATE, ETC.

Sensitiser for Blue Paper.

A.	Ferric ammonium citrate (green)*	110 grs.	250 gms.
	Water	1 oz.	1000 c.c.s.
B.	Potass ferricyanide	40 grs.	90 gms.
	Water	1 oz.	1000 c.c.s.

Mix in equal parts, keep in the dark and filter just before use.

Solution for Writing Titles on, removing blue lines from blue prints, etc.—Potass oxalate, 75 grs. per oz.; 170 gms. per 1000 c.c.s.

SEPIA PAPER.

A.	Ferric ammonium citrate (green)	110 grs.	250 gms.
	Water	1 oz.	1000 c.c.s.
B.	Tartaric acid	18 grs.	40 gms.
	Water	1 oz.	1000 c.c.s.
C.	Silver nitrate	45 grs.	100 gms.
	Water	1 oz.	1000 c.c.s.
D.	Gelatine	30 grs.	70 gms.
	Water	1 oz.	1000 c.c.s.

Equal parts (say 1 oz. of each) of these solutions are mixed as follows:—D is rendered just fluid on a water bath, A and B added, and lastly C, a few drops at a time. The prints are fixed in 1 : 50 hypo.

PELLET PROCESS.

A.	Pure gum arabic	4 ozs.	200 gms.
	Water	20 ,,	1000 c.c.s.
B.	Ferric ammonium citrate	10 ,,	500 gms.
	Water	20 ,,	1000 c.c.s.
C.	Ferric chloride (crystallised)	10 ozs.	500 gms.
	Water	20 ,,	1000 c.c.s.

Take 8 vols. of B, then 5 vols. of C, to 20 vols. of A, in small doses with constant stirring.

The prints are developed in 10 per cent. solution of potass ferrocyanide and "fixed" in 1 : 25 sulphuric acid.

THE FERRO-GALLIC PROCESS.

Gum arabic	60 grs.	135 gms.
Warm water	1 oz.	1000 c.c.s.

* If the ordinary brown citrate is used, the formula should contain 80 grs (183 gms.), and the ferricyanide should be increased to 60 grs. (137 gms.)

When dissolved add the following in the order given—

Tartaric acid	8 grs.	18 gms.
Salt	36 ,,	81 ,,
Ferric sulphate	40 ,,	90 ,,
Ferric chloride	60 ,,	135 ,,

The developer for the prints is :—Alum and gallic acid, 1 part of each ; water, 80 parts.

MOUNTANTS.

GELATINE.

(For mounting prints without cockling.)

Nelson's No. 1 gelatine ...	4 ozs.	50 gms.
Water	16 ,,	200 c.c.s.

Soften the gelatine in the water, liquify on the water bath, and add a little at a time and stirring rapidly.

Methylated spirit	5 ozs.	30 c.c.s.
Glycerine	1 oz.	6 ,,

The mountant is used hot: A piece of ground glass is dipped in hot water, drained, and the mountant brushed over. The print is then laid face up on the pasted surface and rubbed gently in contact with a piece of paper, being then removed and pressed down on its mount.

DEXTRINE PASTE.

Best white dextrine	1 lb.
Cold water	to make stiff paste.
Water	10 ozs.
Oil of wintergreen	1 dram

Mix the dextrine and water together in small doses of each so as to ensure a mixture free from lumps and clots. Dilute with the further quantity of water, add the oil and just bring the whole mixture to the boil when it should be like clear gum. Pour into pots, cover up and in from 12 to 24 hours it will be set to a hard and white paste of great adhesive power. The dextrine must be the best white: inferior dextrine remains treacly on cooling.

STARCH-GELATINE.

A.	Bermuda arrowroot	8 ozs.	200 gms.
	Water	4 ,,	100 c.c.s.
B.	Nelson's No. 1 soft gelatine ...	360 grs.	10 gms.
	Water	64 ozs.	800 c.c.s.

The gelatine is first softened in the water and A and B are then mixed together and boiled for a few minutes. To the cold mixture are stirred in—

Methylated spirit	5 ozs.	250 c.c.s.
Carbolic acid (liquid)	25 minims	3 c.c.s.

This is a good cold paste, which sticks and keeps fairly well.

LIQUID GELATINE.

Gelatine	1 oz.	100 gms.
Water	6 ozs.	600 c.c.s.
Chloral hydrate...	1 oz.	100 gms.

The gelatine is dissolved in the water by aid of heat and the chloral hydrate added. After digesting for a short time the adhesive liquid is neutralised with a little sodium carbonate solution.

SHELLAC MOUNTANT.

A strong solution of shellac in methylated spirit, or better, rectified spirit, is thinly applied to both mount and print and the two coated surfaces quickly rubbed into contact. A good method of fixing prints to thin mounts in albums etc.

AFFIXING PAPER TO METAL.

Tragacanth	3 ozs.	3 gms.
Gum arabic	12 ,,	12 ,,
Water	50 ,,	50 c.c.s.
or—		
Gum arabic	1 oz.	10 gms.
Water	10 ozs.	100 c.c.s.
Aluminium sulphate	45 grs.	1 gm.

SPOTTING, COLOURING, ETC., PRINTS.

LUBRICANT FOR BURNISHING PRINTS.

Castile soap	20 grs.	5 gms.
Alcohol	10 ozs.	1000 c.c.s.

Encaustic Paste.

Pure wax...	5 ozs.	500 gms.
Gum elemi	45 grs.	10 ,,
Benzole	2 ozs.	200 c.c.s.
Essence of lavender	3 ,,	300 ,,
Oil of spike	1 drachm	15 ,,

Or, paraffin wax with oil of lavender enough to make a stiff paste.

Baskett's Formula.

To the contents of a 2d. tin of Globe polish add 1 oz. best olive oil and 1 oz. terebine. Apply with soft cloth, and polish.

Preparing Prints for Colouring.

(For gelatine prints.)

Oxgall paste	60 grs.	3.5 gms.
Distilled water	16 ozs.	400 c.c.s.
Rectified spirit	4 ,,	100 ,,

This medium is applied with a flat camel-hair brush to the print, which, when dry, is ready for colouring in either oil or water-colours.

(For collodion prints.)

Quillaia bark (powdered) ...	50 grs.	10 gms.
Cold water	1 oz.	100 c.c.s.

Soak for 12 hours with occasional stirring, and add—

Alcohol	1 oz.	100 c.c.s.
Salicylic acid	5 grs.	1 gm.

To prepare bromide prints for working up with crayon or stump, apply fine pumice-stone powder with soft pad or palm of hand.

Fixatif for Crayon and Pastel Work.

A. Mastic	24 grs.	1.6 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation and allow to stand some hours before use.

B. Celluloid (film clippings free from emulsion will do) ...	7 grs.	.45 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation. Mix when both are clear, and keep in tightly corked bottle. Apply with spray diffuser.

Spotting Prints.

For spotting prints to be glazed by stripping from plain or collodionised glass, tubes of artists' oil colours are thinned with benzole and dammar varnish and used as spotting media.

MISCELLANEOUS FORMULÆ.

THE DUSTING-ON PROCESS.

Best gum arabic	80 grs.	5.2 gms.
White sugar	60 ,,	4.0 ,,
Ammonium bichromate ...	60 ,,	4.0 ,,
Water	7 ozs.	200 c.c.s.
Methylated spirit	1 oz.	30 ,,

This mixture will keep for a few days only, and after the plate has been coated and exposed it is developed with finest graphite powder, collodionised, and washed.

To Recover Fogged Plates.

Make a solution as follows :—

Chromic acid	30 grs.	7 gms.
Bromide of potassium... ...	60 ,,	14 ,,
Water	10 ozs.	1000 c.c.s.

And immerse the plates for five minutes. Afterwards wash very thoroughly, and rear up to dry.

Backing Sheets for Dry Plates.

Gelatine	1 part	50 gms.
Water	2 parts	100 c.c.s.
Glycerine	1 part	50 ,,
Indian ink	A small addition.	

Make a paste, and coat strong paper ; place the prepared material, face downwards, on waxed glass to set. Press to back of plate before putting into dark slide.

Backing for Dry Plates to Prevent Halation (Teape's).

Gum solution (ordinary office gum)	1 oz.	100 c.c.s.
Caramel	1 ,,	100 gms.
Burnt sienna, ground in water	2 ozs.	200 ,,

Mix and add—

Alcohol	2 ,, (fl.)	200 c.c.s.

Colour for Applying to Bright Machinery Prior to Photographing it.

Mix white lead with turpentine to the consistence of thin cream with sufficient lamp-black to form a light slate colour, and then add one-sixth the bulk of japanners' gold size. Paint the machinery over with this. After the photograph has been taken, the colour can be quickly removed with a pledget of "cotton waste" moistened with turpentine or benzoline.

White Ink for Lantern Slides' Masks.

A mixture is made of water (containing about 40 grains per ounce of gum arabic) and artists' zinc white.

Ink for Rubber Stamps.

Aniline red (violet)	900 grs.	210 gms.
Boiling distilled water... ...	10 ozs.	1000 c.c.s.
Glycerine	about $\frac{1}{2}$ oz.	60 ,,
Treacle	about $\frac{1}{4}$,,	30 ,,

Invisible Ink.

Chloride of cobalt	25 grs.	60 gms.
Distilled water...	1 oz. (fl.)	1000 c.c.s.

Writing executed with this ink is first pink on paper, becoming invisible on drying. On warming, the writing turns blue.

Dead Black for Wood.

Borax	30 grs.	8 gms.
Glycerine	30 minims	8 c.c.s.
Shellac	60 grs.	16 gms.
Water	8 ozs.	1000 c.c.s.

Boil till dissolved and add—

Nigrosine W.S....	60 grs.	16 gms.

Or paint the wood first with

Cupric chloride	75 grs.	75 gms.
Potassium bichromate... ...	75 ,,	75 ,,
Water	2¼ ozs.	1000 c.c.s.

and as soon as the surface dries apply

Aniline hydrochlorate... ...	150 grs.	150 gms.
Water	2¼ ozs.	1000 c.c.s.

and wipe off any yellow powder that forms. Repeat the process till black enough, and then rub over with boiled linseed oil.

Waterpoofing Solution for Wood.

Ashphalt...	4 ozs.	400 gms.
Pure rubber	30 grs.	6 ,,
Mineral naphtha	10 ozs.	1000 c.c.s.

Apply with a stiff brush and give three successive coats, allowing to dry between each. The vapour from this solution is very inflammable.

Polish for Cameras, Woodwork, etc.

Linseed oil	20 ozs.	400 c.c.s.
Spirits of camphor	2 ,,	40 ,,
Vinegar	4 ,,	80 ,,
Butter of antimony	1 oz.	20 gms.
Liquid ammonia	¼ ,,	5 c.c.s.
Water	¼ ,,	5 ,,

This mixture is applied very sparingly with a bit of old flannel, and thoroughly rubbed off with soft rags.

Blackening Brass Work.

A.	Copper nitrate	200 grs.	450 gms.
	Water	1 oz.	1000 c.c.s.
B.	Silver nitrate	200 grs.	450 gms.
	Water	1 oz.	1000 c.c.s.

Mix A and B, and place the brass-work (perfectly cleaned) in the solution for a few moments, heating it on removal.

Hurter and Driffield's Standard Ferrous Oxalate Developer (*The Photographic Journal*, 1898).

A.	Potassium oxalate	1 part
	Water	4 parts
B.	Ferrous sulphate	1 part
	Citric acid	0.01 ,,
	Water...	3 parts
C.	Potass bromide	1 part
	Water...	100 parts

For use take A, 100 parts; B, 25 parts; C, 10 parts. Development to be conducted at a temperature of 65° F.

The ferrous oxalate as compounded above contains in every 1000 parts :—Potassium oxalate, 185 parts ; ferrous sulphate, 68.5 parts ; citric acid, .61 parts ; potassium bromide, .74 parts.

DIOGEN.

Concentrated Solution.

Sodium sulphite	8 ozs.	400 gms.
Diogen	2 ,,	96 ,,
Distilled water	20 ,,	1000 c c.s.
Potassium carbonate	10 ,,	500 gms.

For correct exposure mix .—

Concentrated solution ...	4 drachms	14 c.c.s.
Water	17 ,,	60 ,,
Potassium bromide 10 per cent. solution	2 drops	2 drops

Chemically diogen is the acid sodium salt of an amido-naphthol-disulphonic acid.

Varnish for Brass-Work.

Celluloid...	10 grs.	4 gms.
Amyl alcohol	½ oz.	100 c.c.s.
Acetone	½ ,,	100 ,,

Instead of this cold celluloid varnish, commercial "cold lacquer" can be used.

TO BLACKEN ALUMINIUM.

Clean the metal thoroughly with fine emery powder, wash well, and immerse in—

Ferrous sulphate	1 oz.	80 gms.
White arsenic	1 ,,	80 ,,
Hydrochloric acid	12 ozs.	1000 c.c.s.

Dissolve and add—

Water	12 ozs.	1000 c.c.s.

When the colour is deep enough dry off with fine sawdust and lacquer.

SILVERING MIRRORS.

(*Lumiere's Process.*)

The glass to be silvered should be well cleaned with pure nitric acid, then well washed with distilled water and levelled and flooded with a mixture of—

Water	3 ozs.	75 c.c.s.
Rectified spirit	1 oz.	25 ,,

and allowed to remain several minutes, whilst the following solution is prepared—

Formaline 40 %	10 drops.	10 drops
Rectified spirit	170 minims	10 c.c.s.
Distilled water	170 ,,	10 ,,
Solution of silver nitrate ...	¾ oz.	20 ,,

The solution of silver is prepared as follows :—

Silver nitrate	155 grs.	10 gms.
Distilled water	$3\frac{1}{2}$ ozs.	100 c.c.s.

When dissolved add strong ammonia .880 drop by drop, with constant stirring, till the precipitate first formed is just re-dissolved. Excess of ammonia should be avoided. Then add—

Siver nitrate	30 grs.	2 gms.
Distilled water	$3\frac{1}{2}$ ozs.	100 c.c.s.

and make the total bulk 35 ozs. or 1000 c.c.s., and filter two or three times till absolutely bright and clear. Drain the plate after the alcohol bath and pour the silvering solution over it and gently rock. Deposition begins in from 90 to 120 seconds, and the action should be allowed to continue till the solution turns thick, at which stage pour the solution off and flood with fresh. This operation may be repeated three or four times if necessary, or until a sufficiently thick film is obtained, then rinse and dry. Polish with a chamois leather dusted with "gold rouge." The spirit tends to prevent the formation of too rapid a deposit, and the necessary amount of formaline should be found by preliminary test. The above quantity is sufficient for a sheet of glass 24 × 18 cms., and the temperature should be from 16 to 20 degrees C. Practically 170 minims are sufficient for 16 sq. in.

SILVERING MIRRORS (MARTIN'S METHOD).

(*In employing the following formulæ, it should be well understood that the glass plate to be silvered must be scrupulously clean*).

A.	Nitrate of silver	175 grs.	40 gms.
	Distilled water	10 ozs.	1000 c.c.s.
B.	Nitrate of ammonium... ...	262 grs.	60 gms.
	Distilled water	10 ozs.	1000 c.c.s.
C.	*Pure* caustic potash	1 oz.	100 gms.
	Distilled water	10 ozs.	1000 c.c.s.
D.	Pure sugar candy	$\frac{1}{2}$ oz. (avoir.)	100 gms.
	Distilled water	5 ozs.	1000 c.c.s.

Dissolve and add—

Tartaric acid	50 grs.	23 gms.

Boil in flask for 10 minutes, and when cool add—

Alcohol	1 oz.	200 c.c.s.

Distilled water *quant. suff*. to make up to 10 ozs. or 2000 c.c.s.

For use, take equal parts of A and B. Mix together also equal parts of C and D, and mix in another measure. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downward in the solution.

DEVELOPING FORMULÆ, ETC., OF THE PRINCIPAL PLATE AND PAPER MAKERS.

AUSTIN EDWARD'S FORMULÆ.

PYRO.

No. 1.	Pyrogallic acid	1 oz.	12.5 gms.
	Nitric acid	20 drops	0.5 c.c.
	Water	8 ozs.	1000 c.c.s.
No. 2.	Sulphite of soda	$2\frac{1}{2}$,,	125 gms.
	Carbonate of soda (crystals) ...	$2\frac{1}{4}$,,	113 ,,
	Water	20 ,,	1000 c.c.s.

Add the acid to the water before dissolving the pyro.
For correct exposure, use equal parts of Nos. 1 and 2.
For known over-exposure, use 2 parts No. 1 and 1 part No. 2.

HYDROQUINONE.

No. 1.	Water	20 ozs.	1000 c.c.s.
	Hydroquinone	120 grs.	14 gms.
	Sulphite soda	2 ozs.	100 ,,
No. 2.	Water	20 ,,	1000 c.c.s.
	Carbonate of potash	4 ,,	200 gms.
	Bromide potassium	30 grs.	3.5 ,,

Dissolve the hydroquinone in the water before adding the sulphite. For use take equal parts of each.

HYDROQUINONE DEVELOPER FOR LANTERN PLATES.

(For Black Tones.)

Distilled water	20 ozs.	1000 c.c.s.
Hydroquinone	60 grs.	7 gms.
Sulphite soda	2 ozs.	100 ,,
Carbonate soda (crystals) ...	6 ,,	300 ,,
Bromide potassium	40 grs.	4.6 ,,

Dissolve the hydroquinone in the water and add the other ingredients in the order named.

Time of development, if exposed correctly, about 2 minutes. This developer may be used several times.

PYRO DEVELOPER.

(For Warm Tones.)

1.	Water	20 ozs.	1000 c.c.s.
	Nitric acid	20 drops	2 ,,
	Sulphite soda	4 ozs.	200 gms.
	Pyrogallic acid	1 oz.	50 ,,
2.	Water	20 ozs.	1000 c.c.s.
	Bromide ammonium (not potass)	3 ,,	150 gms.
	Liquid ammonia (.880) ...	1 oz.	50 c.c.s.

Add the acid to the water, and the other ingredients in the order named.

For use, take 1 part each of Nos. 1 and 2, and dilute with equal quantities of water. For still warmer tones, add 1 part more water, or again double the exposure and add one-fourth more No. 2. This developer may be used several times.

BAYER CO., LTD.

Developer for "Pan" Paper.

Water	10 ozs.	1000 c.c.s.
Sodium sulphite (cryst.) ...	1¼ oz.	125 gms.
Hydroquinone	72 grs.	16 ,,
Soda carbonate (cryst.) ...	2½ ,,	250 ,,
Potass bromide...	48 ,,	11 ,,

Developer for "Tula" and "St. Luke's" Papers.

Potass metabisulphite... ...	48 grs.	1 gm.
Edinol crystals	24 ,,	½ ,,
Potass carbonate (cryst.) ...	144 ,,	3 gms.
Water	10 ozs.	100 c.c.s.
Potass bromide (10 % solution)	6 drops	2 drops

The above developer, when freshly made, gives blue-black tones; when standing for some time, brown-black tones.

Developer for Bromide Paper.

A. Edinol crystals	1 oz.	10 gms.
Acetone sulphite crystals ...	5 ozs.	50 ,,
Or—		
Sodium sulphite	10 ,,	100 ,,
Water	100 ,,	1000 c.c.s.
B. Potass carbonate crystals ...	25 ,,	250 gms.
Water	50 ,,	500 c.c.s.

For use, take 4 ozs. A, 1 oz. B, and 5 drops of potassium bromide solution 10 per cent.

Toning Bath for P.O.P.

1. Water	20 ozs.	800 c.c.s.
Alum	180 grs.	15 gms.
Ammonium sulphocyanide ...	180 ,,	15 ,,
Ammonium carbonate... ...	12 ,,	1 gm.
2. Gold chloride	4 ,,	1 ,,
Water	5 ozs.	600 c.c.s.

An hour before use, mix 4 parts of No. 1 with 1 part No. 2, but only as much as is required at the time. The prints should be thoroughly washed in several changes of water before toning, until the last wash-water does not show any further traces of milkiness.

CADETT & NEALL, LTD.

(Developers for "Lightning," "Special Rapid," "Cadett," "Professional," and "Ordinary" plates.)

No. 1.—Pyro-Soda Developer.

Stock Solution.

Pyrogallic acid	1 oz.	28 gms.
Potassium metabisulphite ...	30 grs.	2 ,,
Distilled or soft water to make altogether 9 ozs. (fl.) and 55 minims or 280 c.c.s.		

Every 10 minims of stock pyro-solution contains 1 grain of pyrogallic acid.

A. Stock solution	3 ozs. (fl.)	150 c.c.s.
Distilled or soft water to make altogether	20 ,, ,,	1000 ,,
B. Sodium carbonate (cryst.) or washing soda (select translucent pieces)...	710 grs.	80 gms.
Sodium sulphite (cryst.) ...	700 ,,	80 ,,
Distilled water to make altogether	20 ozs. (fl.)	1000 c.c.s.

Generally common washing soda is sufficiently good; sometimes, however, it is very impure.

Equal parts of A and B to make developer.

No bromide is necessary with proper exposure, but a few drops of 10 per cent. solution of potassium bromide may be added to the developer when necessary; this produces brilliancy and clearness, but reduces speed. In very hot weather the hypo bath should not be stronger than 1 lb. (or 400 gms.) of sodium hyposulphite to 2 quarts (or 2000 c.c.s.) of water.

Clearing Bath.

A clearing bath may be used if desired, but alum alone must not be used. The following bath works well:—

Saturated solution of alum ...	20 ozs. (fl.)	1000 c.c.s.
Strong nitric or hydrochloric acid	1 drachm (fl.)	5 ,,

No. 2.—Metol Hydrokinone.

This developer is one giving great brilliancy and is particularly recommended for rapid plates.

One Solution only.

Hydrokinone	130 grs.	8 gms.
Metol	50 ,,	3 ,,
Sodium sulphite (cryst.) ...	2 ozs. avd.	60 ,,
or instead (anhydrous ..	1 oz. ,,	30 ,,
Sodium carbonate (cryst.) ...	3 ozs. ,,	90 ,,
or instead (anhydrous)...	1 oz. ,,	30 ,,
Potassium bromide	4 grs.	0.5 gm.
Distilled or soft water... ...	1 pint	1 litre

No. 3.—Metol Developer.

This developer gives softer negatives than the previous one It more suitable for plates of slow and medium rapidity.

One Solution only.

Distilled or soft water... ...	80 ozs. (fl.)	2000 c.c.s.
Metol	1 oz. avd.	25 gms.
Sodium sulphite (pure re-cryst.)	5 ozs.	125 ,,
Sodium carbonate (cryst.) washing soda (select translucent pieces)...	6¾ ,,	170 ,,
or instead anhydrous sodium carbonate	2½ ,,	80 ,,

These must be completely dissolved in the order named, the water not being colder than 60 degrees F.

This developer keeps fairly well in stoppered bottles, is ready for use without further dilution and may be used several times.

Fixing Solution.

Hypo	1 lb.	400 gms.
Water	1 quart	1000 c.c.s.

No. 4.—Ortol Developer.

A. Potassium metabisulphite ...	200 grs.	5 gms.
Ortol	400 ,,	10 ,,
Distilled water	40 ozs. (fl.)	1000 c.c.s.
B. Potassium carbonate (anhydrous)	900 grs.	20 gms.
Sodium sulphite (recryst.) ...	6 ozs. avd.	60 ,,
Potassium bromide	40 grs.	1 gm.
Distilled water	40 ozs. (fl.)	1000 c.c.s.

Equal quantities of A and B to make developer.

Cadett & Neall's Dagas Paper.

Development.—Metol hydroquinone should be used for developing Dagas paper, and should be made in strict accordance with the following formula:—

Metol	20 grs.
Hydroquinone	65 ,,
Sodium carbonate (cryst.)	1½ ozs.
Sodium sulphite	1½ ,,
Water	20 ,,
Potassium bromide (10 %)	40 drops

This developer will keep for some considerable time in well-stoppered bottles, but when once used should not be put back with the stock solution.

Cadett & Neall's Royal Standard Plates.

Developing Formulæ.

Avoirdupois weight.

Pyro Developer.

A.	Water	16 ozs.	1000 c.c.s.
	Sodium sulphite (crystals) ...	1 oz.	60 gms.
	Pyro	1 ,,	60 ,,
	Citric acid	20 grs.	1 gm.
B.	Water	16 ozs.	1000 c.c.s.
	Sodium sulphite (crystals) ...	4 ,,	240 gms.
C.	Water	16 ,,	1000 c.c.s.
	Sodium carbonate (crystals) ...	4 ,,	240 gms.

To develop, take—

A.	1 oz.	1 part
B.	1 ,,	1 ,,
C.	1 ,,	1 ,,
Water*	8 ozs.	8 parts

Less of B will give a warmer tone to negative. If negatives are too yellow, use more of B.

The best printing colour is a brownish black, but for this colour do not carry development quite so far as with developers which give a bluish or greyish black image. These latter colours should be avoided.

A two-solution developer can be made from the above by dissolving the sulphite and carbonate *together* in 32 ozs. water and using 1 oz. A, 2 ozs. of mixture, and 8 ozs. water.

Eikonogen-Hydroquinone Developer

No. 1.	Water	32 ozs.	1000 c.c.s.
	Sodium sulphite (crystals) ...	4 ,,	120 gms.
	Eikonogen	240 grs.	16 ,,
	Hydroquinone	60 ,,	4 ,,
No. 2.	Water	32 ozs.	1000 c.c.s.
	Sodium carbonate (crystals) ...	8 ,,	240 gms.

To develop, take—

No. 1	2 ozs	2 parts
No. 2	1 oz.	1 part
Water*	1 ,,	1 ,,

Metol-Hydro Developer.

A.	Water	16 ozs.
	Metol	30 grs.
	Hydroquinone	30 ,,
	Sodium sulphite (crystals)	240 ,,
B.	Water	16 ozs.
	Potassium bromide	15 grs.
	Sodium carbonate (crystals)	240 ,,

* More water gives less contrast and density.

To develop take equal parts of A and B. Developer should be about 70 degrees F., and can be used repeatedly, but should be discarded as soon as discoloured, as it will then stain the film.

Cadett & Neall's "Cadett" Bromide Papers.

No. 1.—Metol Developer.

A.	Metol	400 grs.	11 gms.
	Sodium sulphite (cryst.) ...	8 ozs. avd.	100 ,,
	Potassium bromide	50 grs.	1.4 gm.
	Distilled or boiled water ...	80 ozs. (fl.)	1000 c.c s.
B.	Sodium carbonate (cryst.) or washing soda—select translucent pieces	5 ozs. avd.	60 gms.
	Distilled or boiled water ...	80 ,, (fl.)	1000 c.c.s.

These must be completely dissolved in the order named, the water not being colder than 60 degrees F.

Take equal parts of A and B to make the developer. It will be found that this developer works with great rapidity. Variations may be made in the brilliancy of the prints by altering exposure, time of development, and by diluting the developer with water. Should the prints be too brilliant, increase exposure and dilute the developer. Remember that prints appear more brilliant when wet than when dry. This developer keeps fairly well in stoppered bottles.

Fixing Solution.

Hyposulphite of soda	½ lb.	200 gms.
Water	1 quart	1000 c.c.s.

After fixing and thorough washing if the prints be placed in a solution of alum—

Alum	2 ozs. avd.	25 gms.
Water	80 ,, (fl.)	1000 c.c.s.

and then well washed, mounting will be greatly facilitated.

Bromide prints should be dried before mounting, the mountant being applied to the dry print.

For very brilliant prints we recommend the following :—

No. 2.—Metol Hydrokinone.

A.	Metol	100 grs.	6 gms.
	Hydrokinone	50 ,,	3 ,,
	Sodium sulphite (cryst. and *fresh*)	2 ozs. avd.	29 ,,
	Water to make altogether ...	40 ,, (fl.)	1000 c.c.s.
B.	Sodium carb. (cryst.), *washing* soda, select translucent pieces	1 oz. avd.	25 gms.
	Potassium bromide	60 grs.	3 ,,
	Water to make altogether ...	40 ozs. (fl.)	1000 c.c.s.

Equal parts of Nos. 1 and 2 to make developer.

No clearing solution required.

Fixing.

Hyposulphite of soda	½ lb.	200 gms.
Water	1 quart	1000 c.c.s.

This developer works slowly, but gives very brilliant prints.

The potassium bromide may be reduced if thought desirable, or omitted altogether.

No. 3.—Amidol Developer.

Amidol	60 grs.	4 gms.
Sodium sulphite...	2 ozs. avd.	20 ,,
Distilled water	40 ,, (fl.)	1000 c.c.s.

Add 1 or 2 drops of a 10 per cent. solution of potassium bromide to every 2 ozs. of developer.

Toning.

The following formulæ gives excellent results. Prepare the following three solutions :—

No. 1. Copper sulphate (pure)	1 oz. avd.
Boiled or distilled water	10 ozs. (fl.)
No. 2. Neutral potassium citrate	8 ,, avd.
Boiled or distilled water	80 ,, (fl.)
No. 3. Potassium ferricyanide	1 oz. avd.
Boiled or distilled water	10 ozs. (fl.)

The potassium ferricyanide solution should be kept in the dark in well-corked bottle.

To make the toning solution take—

Solution No. 1	1 oz. (fl.)
Solution No. 2	8 ozs. (fl.)
Solution No. 3	7 drachms (fl.)

Add No. 1 to 2 and then add No. 3. The complete solution can then be diluted with one or two or more parts of water if desired, especially should toning proceed too rapidly, where slight toning for rich brownish black is desired.

The following method for obtaining Sepia Tones can be strongly recommended :—

After fixing and thoroughly washing, place the print in the following solution.—

Tincture of iodine (British pharmacopœia) ...	1 oz.
Water...	10 ozs.

The solution can be made stronger or weaker if desired. It need not be thrown away after use, but returned to the bottle and fresh tincture added as required. It should not be left in strong daylight.

Rock the solution over the print, so as to help even action. If warm blacks are wanted, the solution must act only for a short time, and not be too strong. If for warm sepia tones, the solution must act until the image is thoroughly converted into silver iodide, which will take about five minutes ; the print then looks like a negative, the high lights and white portions becoming blue-black by formation of iodide of starch in papers containing starch.

Wash the print in running water to remove any free iodine, and then place the print in the following solution :—

Sodium sulphite	1 oz.
Water...	10 ozs.

After a few minutes the iodine will be removed from the starch, and the print becomes white again. Then wash for ten minutes, and place the print in the following solution :—

Ammonium hydro-sulphuret (solution fortior)	1 oz.
Water	20 ozs.

This solution is also known as ammonium sulphide solution ; it has a very unpleasant smell, and the windows of the room in which it is used should be opened. The print immediately changes from warm black to complete sepia in this solution, according to the length of time the print has been in the iodine solution.

The tones are very fine and easily obtained, and we believe them to be as permanent as any silver printing process can give.

B. J. EDWARDS & CO.

Hydroquinone Developer.

No. 1.	Hydroquinone	¼ oz.	7 gms.
	Sulphite of soda	1 ,,	30 ,,
	Bromide of potassium... ...	7 grs.	½ gm.
	Distilled boiling water to make	12 ozs.	340 c.c.s.
No. 2.	Carbonate of potash	½ oz.	15 gms.
	Distilled water to make ...	12 ozs.	340 c.c.s.

First dissolve the hydroquinone, and then add the sulphite and bromide.

For use, mix equal parts of Nos. 1 and 2.

Eikonogen Developer.

Eikonogen	½ oz.	14 gms.
Carbonate of potash	1 ,,	30 ,,
Sulphite of soda	2 ozs.	60 ,,
Distilled boiling water ...	20 ,,	600 c.c.s.

First dissolve the eikonogen, then the sulphite, and lastly the carbonate of potash.

Instead of mixing the developers, the development may be commenced with eikonogen, and when the detail is sufficiently out, hydroquinone substituted for it, without waiting to wash the negative, and the development finished with this, or in case of much over-exposure with the following hydroquinone re-developer :—

Hydroquinone Re-developer.

No. 1.	Hydroquinone	¼ oz.	7 gms.
	Sulphite of soda...	2 ozs.	60 ,,
	Bromide of potassium	¼ oz.	7 ,,
	Distilled boiling water to make	12 ozs.	340 c.c.s.

No. 2. Carbonate of soda (washing soda)	2 ozs.	60 gms.
Sulphite of soda	2 ,,	60 ,,
Distilled water to make ...	12 ,,	340 c.c.s.

For use, mix equal parts of Nos. 1 and 2.

ELLIOTT & SONS' FORMULÆ.

For Barnet "Red Seal" and "Ortho" plates.

Developer.

Stock Solution A.—Dissolve 100 grs. of potass metabisulphite in water, then add 1 oz. pyro and 60 grs. potassium bromide, and make up with water to measure 8 ozs.

No. 1 Solution.

Stock solution A	2 ozs.
Water	18 ,,

No. 2 Solution.

Soda carbonate crystal	2 ozs.
Soda sulphite	$2\frac{1}{4}$,,
Water to make	20 ,,

For use, take equal parts Nos. 1 and 2. For soft negatives or for portraiture, etc., take 1 part of No. 1, 2 parts No. 2, and 1 part of water.

For "Barnet" Medium Extra Rapid and "Rocket" plates, and "Barnet" Roll films :—

No. 1 Solution.

Pyro	1 oz.	12 gms.
Potass bromide	60 grs.	2 ,,
Water	80 ozs.	1000 c.c.s.
Pure nitric acid	20 drops	.5 c.c.

No. 2 Solution.

Soda sulphite	9 ozs.	112 gms.
Soda carb. crystal	8 ,,	100 ,,
Water	80 ,,	1000 c.c.s.

For *ordinary use*, equal parts of No. 1 and 2. For *under exposure* add more of No. 2, or dilute the developer with water. For over exposure add more of No. 1, or a few drops of a 10 per cent. solution of potassium bromide.

"Barnet" Lantern Transparency Plates.

For Cold or Warm Tones (according to exposure and development.)

Instructions for Use.

Contact Printing.—For black tones the exposure required is about 10 seconds at a distance of 1 foot from an ordinary gas flame ; the developer to be used in either No. 1 or 2.

To secure warm tones it is necessary to increase the exposure to 2 or 3 minutes and use formula either No. 3 or 4.

To obtain still warmer (reddish) tones, increase the exposure still further to 5 or 6 minutes and develop with formula No. 5.

Reductions in the Camera.—For black tones with stop *f*-16 in bright diffused light from a half-plate negative an exposure of about 10 seconds is required, using formula No. 1 or 2 for developing.

For warm tones increase the exposure to 2 or three minutes and using for developer either formula No. 3 or 4.

For still warmer tones further increase the exposure to 5 or 6 minutes and develop with formula No. 5.

Formulæ for Developers.

Note.—In cold weather all solutions should be raised to a temperature of 60 degrees.

Cold Black Tones.

A.

No. 1.	Metol	... 400 grs.	11 gms.
	Soda sulphite	... 8 ozs.	100 ,,
	Water	... 80 ,,	1000 c.c.s.

B.

Carbonate of potash ...	...1200 grs.	34 gms.
Ammonium bromide ...	... 240 ,,	7 ,,
Potassium bromide ...	... 480 ,,	14 ,,
Water	... 80 ozs.	1000 c.c.s.

Take equal parts of A and B.

Note.—The ammonium bromide is necessary for the production of absolutely cold black tones; a larger quantity is not recommended, as it tends to produce a slight veil in the high lights.

Length of time in developing about 2 minutes.

Warm Black Tones.

A.

No. 2.	Hydroquinone	... 640 grs.	18 gms.
	Soda sulphite	... 8 ozs.	100 ,,
	Potass bromide	... 120 grs.	3 ,,
	Citric acid	... 240 ,,	7 ,,
	Water	... 80 ozs.	1000 c.c.s.

B.

Sodium hydrate ...	... 640 grs.	18 gms.
Water	... 80 ozs.	1000 c.c.s.

Take equal parts of A and B.

This produces a very pleasing warm black. Length of time in developing about 2 minutes.

Warm Brown Tones.

A.

No. 3. Pyro	1 oz.	12.5 gms.
Soda sulphite	4 ozs.	50 ,,
Water	80 ozs.	1000 c.c.s

B.

Carbonate of ammonia ...	900 grs.	26 gms.
Potassium hydrate	750 ,,	21 ,,
Ammonium bromide	600 ,,	17 ,,
Water	80 ozs.	1000 c.c.s.

Take equal parts of A and B.

Length of time in developing about 2 minutes.

Or the following may be used :—

No. 4.—Take equal parts of No. 2 formula and add to each ounce (100 c.c.s.) 3 grs. (.6 gm.) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about 3 or 4 minutes.

Very Warm (Reddish) Tones.

No. 5.—Take equal parts of No. 2 formula and add to each ounce (100 c.c.s.) 6 grs. (1.2 gm.) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about 8 minutes.

Fixing Bath.

We recommend the bath not to be made stronger than—

Hypo	5 ozs.	250 gms.
Water	20 ,,	1000 c.c.s.

Clearing solutions will not be found necessary with these plates.

Barnet Bromide Paper.

(Extra Rapid.)

Platino Matt Surface.—Directions for Working.

Exposure.—For contact work from an average negative about 4 seconds, 18 inches from an ordinary gas burner.

For enlarging it is impossible to give any fixed data, so much depending upon the source of light. It is recommended to make a trial exposure upon a small piece of paper.

After exposure place the print, sensitive side upwards, in a clean developing dish, flood with water for a few seconds, drain off water, and then with one sweep cause the developer to flow evenly and quickly over the whole surface of the print.

We strongly recommend the following—

Metol Developer.

A. Metol	400 grs.	11 gms.
Sodium sulphite	8 ozs.	100 ,,
Potass bromide	50 grs.	1.4 gm.
Water	80 ozs.	1000 c.c.s.

B. Potass carbonate	... ...	8 ozs.	100 gms.
Water	... ...	80 ,,	1000 c.c.s.

Take 3 ozs. of A and 1 oz. of B.

The image should appear in a few seconds, and development will be complete in about 2 minutes. Rinse in 3 changes of water and fix in fixing bath as above (no acid bath is necessary with this developer.)

Metol-Hydroquinone.

One-Solution Developer.

Water	... ...	80 ozs.	1000 c.c.s.
Metol	... ...	200 grs.	6 gms.
Soda sulphite ...	... ...	6 ozs.	75 ,,
Hydroquinone ...	... ...	150 grs.	4 ,,
Potass carbonate	... ...	2 ozs.	25 ,,
Potass bromide...	... ...	50 grs.	1.5 gm.

Development will be complete in from 1 to 2 minutes.

For softer prints, either of the above may be diluted with an equal bulk of water just before use.

After fixing, wash thoroughly in several changes of water for at least 2 hours, squeegee off the superfluous moisture, and hang up to dry.

GEM DRY PLATE COMPANY'S FORMULÆ.

Developer for Gem "Salon" and "Meteor" Plates.

A. Pyrogallic acid...	... ...	1 oz.	30 gms.
Citric acid ...	... ...	1 ,,	30 ,,
Sulphite of soda	... ...	5 ozs.	150 ,,
Water make up to	... ...	35 ,,	1000 c.c.s.
B. Carbonate of soda	... ...	8 ozs.	240 gms.
Water make up to	... ...	35 ,,	1000 c.c.s.

To develop mix equal parts of A and B. Add 1 drop of 10 per cent. potassium bromide to each oz. of mixed developer.

Fixing Solution.

Hypo	... ...	1 lb.	250 gms.
Water	... ...	64 ozs.	1000 c.c.s.

Lantern Plates.

Developer for Cold or Warm Tones.

(Cold Tones.)

For Lantern Plates (Warm Tones) and Chloride Plates.

A. Hydroquinone ...	... ...	120 grs.	8 gms.
Potass bromide ...	... ...	180 ,,	12 ,,
Potass metabisulphite...	...	120 ,,	8 ,,
Water	... ...	30 ozs.	900 c.c.s.
B. Caustic potash (sticks)	...	240 grs.	16 gms.
Water	... ...	30 ozs.	900 c.c.s.

Use equal parts of A and B.

For warmer tones double the exposure and dilute the developer with water, adding a few drops of a 10 per cent. solution of potassium bromide.

For chloride plates, dilute with water 4 to 8 times.

(Warm Tones.)

C. Ammonium carbonate... ...	1 oz.	10 gms.
Ammonium bromide	1 ,,	10 ,,
Water	20 ozs.	200 c.c.s.

To obtain extra warm tones on "Gem" red lantern plates, give over exposure and develop with one part of solution A and B and 1 part of C, increasing C as the exposure is lengthened.

Gem P.O.P.

Sulphocyanide Bath.

A. Sulphocyanide of ammonium	30 grs.	2 gms.
Water	10 ozs.	284 c.c.s.
B. Gold chloride	2 grs.	0.13 gm.
Water	10 ozs.	284 c.c.s.

Into a portion of A pour in slowly an equal portion of B. Wash print in running water before toning. After toning, rinse in water, and transfer to fixing bath. The above quantity will tone at least 1 sheet of paper.

JOHN J. GRIFFIN & SONS, LTD.

Griffin's Special P.O.P.

Directions for Separate Toning and Fixing.

Wash prints for 10 minutes, then place in—

Gold chloride	1 gr.	.23 gm.
Sulphocyanide of ammonium...	10 grs.	2.3 gms.
Water	10 ozs.	1000 c.c.s.

Remove when the desired colour is attained and fix in—

Water	10 ozs.	1000 c.c.s.
Hypo	1 oz.	100 gms.

Then wash and dry as usual.

Griffin's Professional P.O.P.

Sulphocyanide Bath.

Gold chloride	1½ grs.	.1 gm
Sulphocyanide of ammonia ...	15 ,,	1 ,,
Water	25 ozs.	700 ,,

Fixing Bath.

Hypo	2½ ozs.	125 gms.
Water	20 ,,	1000 c.c.s.

Carbona P.O.P.

1905 *Emulsion.*

The following toning formula is exclusively recommended for giving the best results with Carbona :—

Gold chloride	1 gr.	.23 gm.
Sulphocyanide of ammonia ...	10 grs.	2.3 gms.
Water	10 ozs.	1000 c.c.s.

Combined Toning and Fixing Bath.

The following bath will give excellent results, especially with the rough grade :—

Distilled water	25 ozs.	2000 c.c.s.
Hypo	4½ ,,	250 gms.
Alum	¾ oz.	43 ,,
Sulphocyanide of ammonia ...	150 grs.	20 ,,
Sodium chloride...	1½ ozs.	86 ,,

After a short time the liquid gets thick. It must then be left for eight days and the clear liquid finally poured off. Then add to the clear solution—

Gold chloride	15 grs.	1 gm.
Water	3½ ozs.	100 c.c.s

Platinum Toning Bath.

For the finest black results the following platinum bath should be used :—

Stock Solution.

Potassium chloroplatinite ...	15 grs.	1 gm.
Water	3½ ozs.	100 c.c.s.

For use take—

Stock solution	5½ drachms	20 c.c.s.
Citric acid	80 grs.	5 gms.
Water up to	10 ozs.	280 c.c.s.

"Cyko" Plates, "Snapshot" and "Studio."

Pyro-soda.

A.	Water	10 ozs.	1000 c.c.s.
	Sulphite of soda (cryst.) ...	1 oz.	100 gms.
	Pyrogallic acid	60 grs.	14 ,,
	Bromide of potassium... ...	1 gr.	.23 gm.
B.	Water	10 ozs.	1000 c.c.s.
	Carbonate soda (cryst.) ...	1 oz.	100 gms.

Take equal parts of A and B.

Metol-Hydroquinone.

(One-solution).

Water	10 ozs.	1000 c.c.s.
Metol	13 grs.	3 gms.
Sodium sulphite (cryst.) ...	1 oz.	100 ,,
Hydroquinone	55 grs.	12.5 ,,
Sodium carbonate (cryst.) ...	750 ,,	172 ,,
Bromide of potassium	2 ,,	.5 gm.

Griffin's Snow-White Bromide Paper.

Development.—To develop the image, first plunge the paper in clean water, place at the bottom of a clean porcelain dish, and apply evenly any of the following developers :—

Amidol.

Amidol	70 grs.
Sodium sulphite (cryst.)	650 ,,
Potassium bromide	4 ,,
Water...	20 ozs.

Fixing.—After development rinse print in water, and fix in—

Soda hyposulphite	1 oz.
Water...	10 ozs.

for ten minutes, then wash for half an hour in running water.

Velox Papers.

Developer.

(Dissolve chemicals in the order named.)

Water...	10 ozs.
Metol	7 grs.
Hydroquinone	30 ,,
Sulphite soda (desiccated)	110 ,,
Carbonate soda (desiccated)	150 ,,
10 per cent. solution bromide potassium ...	40 drops

This solution will keep indefinitely if placed in bottles, filled to the neck and tightly corked.

It should be used full strength for "Regular," but can be diluted with equal parts of water when Special Velox is developed.

Acid Fixing Bath.

(Dissolve chemicals in the order named.)

Water...	64 ozs.
Hyposulphite of soda	16 ,,

After the above bath has been made, add to it the following hardening solution :—

Water	5 ozs
Sulphite soda (desiccated)	¼ oz.
Glacial acetic acid (50 per cent.)	1½ ,,
Powdered alum	½ ,,

This solution can be used repeatedly, and one pint of it will fix at least one-half gross 5 × 4 prints.

If sulphite and carbonate soda in crystal form are substituted for desiccated, double the quantities mentioned should be used.

"Gaslyt" Lantern Plates.

Developing Baths.

For Black Tones.

Water	8 ozs.
Metol	4 grs.
Sodium sulphite crystals	75 ,,
Hydroquinone	16 ,,
Sodium carbonate crystal	280 ,,
Potassium bromide	8 ,,

For Warm or Sepia Tones.

Solution (as for black tones)	1 oz.
Water	2 ozs.

Potassium bromide solution, 10 per cent., 10 drops, or 1 gr. of the solid substance.

Fixing Bath.

Stock Solution.

Sulphite of soda	4 ozs.
Citric acid	½ oz.
Water, to make	20 ozs.

To prepare the fixing bath, take stock solution as above 6 drachms, soda hyposulphite 4 ozs., water 20 ozs,

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THE ILFORD FORMULÆ.

For Ilford "Ordinary," "Zenith," "Monarch," "Chromatic," and other Plates.

Stock Solutions.

A. Water	5½ ozs.	550 c.c.s.
Nitric acid	20 minims	1 c.c.
Pyrogallic acid	1 oz.	100 gms.

This solution will keep good for several weeks.

Or—

B. Water	5½ ozs.	550 c.c.s.
Potassium metabisulphite ...	70 grs.	15 gms.
Pyrogallic acid	1 oz.	100 ,,

This solution will keep good for several months.

Working Solutions.

No. 1.

Stock solution of pyro, A or B	1—2 ozs.	100—200 c.c.s.
Water to make up to	20 ,,	1000 ,,

No. 2.

Sodium carbonate, crystals (not bicarbonate) (avoirdupois)	2 ozs.	100 gms.
Sodium sulphite (avoirdupois)	2 ,,	100 ,,
Potassium bromide	20 grs.	2 ,,
Water to make up to	20 ozs.	1000 c.c.s.

For normal exposures take equal quantities of Nos. 1 and 2.

The quantity of stock solution to be used must be regulated by the quality of negative desired. When a full quantity is used, the result is a slowing of the plate, and, at the same time, greater density or contrast of light and shade.

Pour the developer carefully over the plate, avoiding air bubbles, rock the dish, carefully keeping the plate well covered with solution. To obtain proper density, allow the plate to remain after all detail is out. Judge of this by looking through the plate.

To compensate for errors of exposure, the proportions of Nos. 1 and 2 can be varied thus: for under exposure use more of No. 2 than of No. 1, and for over exposure more of No. 1 than of No. 2. It is a good plan, when there is a doubt as to the exposure being correct, to commence the development with twice the quantity of No. 1 than of No. 2, and add more of No. 2 if found desirable. To compensate for under exposure, the mixed developer can also be diluted with water, of course allowing a longer time for its action.

Alum Bath.—After developing, wash the plate well under the tap, and immerse for a few minutes in alum, $1\frac{1}{2}$ oz.; water, 20 ozs.

Fixing.—Wash well again, and fix as usual. Hyposulphite of soda, 1 lb; water, 40 ozs. Allow to remain in this bath for several minutes after fixation is apparently completed.

Never omit the alum bath in hot weather or under other conditions likely to produce frilling.

Ilford P.O.P.

Working Instructions.

Printing.—This should be done in shade by preference, unless negatives are specially strong in contrast. The image loses very little depth in toning, etc.

First washing.—For 10 minutes in several changes.

Hardening Bath.—Soak the prints in

Alum	$1\frac{1}{2}$ oz.
Common salt...	1 ,,
Water...	20 ozs.

for 5 to 10 minutes, keeping them moving all the time.

Second washing.—For 10 minutes in several changes.

Toning.—Any of the recognised formulæ for this class of paper may be used, but for simplicity and excellence of results we recommend the following. Make up the following stock solutions:—

No. 1.	Ammonium sulphocyanide	100 grs.
	Water	10 ozs.

Sodium sulphite	... ...	10 grs.
Water ...	... ...	10 ozs.

This solution must be made up only on the day of using; any left must be thrown away.

3. Gold chloride	... ...	15 grs.
Water ...	... ...	15 ozs.

When mixing either of the following toning baths, bear in mind that this solution must be added last of all.

For the usual toning bath, take 2 ozs. of each of Nos. 1 and 3 and make up to 20 ozs. with water.

For *warm* tones and Special P.O.P. add 1½ to 2 ozs. of No. 2 to the above bath just before toning, and withdraw prints according to tone desired.

Third washing.—For 5 minutes in several changes.

Fixing —Use new solution for each batch of prints. The following is best strength :—

Hypo ...	... ...	3 ozs.
Water ...	... ...	20 ,,

Fixation is complete in about 10 minutes.

Final Washing.—For at least 2 hours in running water, or many changes.

Mounting.—Mount with starch paste in the usual way. Prints thus treated and passed through roll give a fine glossy surface, better than albumen. This paper will also give prints of enamelled surface by squeegeeing down on glass in the usual way.

Special notes.—Do not use any excess of sulphocyanide or sulphite over the quantity mentioned.

Use the washing water and all solutions as cold as possible.

Keep the prints moving whilst in the various solutions.

Ilford Bromide Paper and Opals

Development.

No. 1. Metol	... ...	50 grs.	5.0 gms.
Hydroquinone	... ...	25 ,,	2.5 ,,
Sodium sulphite	... ...	1 oz.	50 ,,
Water up to	... ...	20 ozs.	1000 c.c.s.
No. 2. Sodium carbonate (crystals)	...	½ oz.	25 gms.
Potassium bromide	... ...	30 grs.	3 ,,
Water up to	... ...	20 ozs.	1000 c.c.s.

Take equal quantities of No. 1 and No. 2.

It is important to note that no clearing solution is required with this developer.

Alternative Method of Development.

Make the following solutions and use when cold :—

No. 1. Sulphate of iron...	... ...	2½ ozs.	250 gms.
Sulphuric acid ...	... ...	15 drops	3 c.c.s.
Warm water up to	... ...	10 ozs.	1000 ,,

No. 2. Neutral potassium oxalate ...	10 ozs.	250 gms.
Potassium bromide	20 grs.	1 gm.
Warm water up to	40 ozs.	1000 c.c.s.

For use, add 1 oz. No. 1 to 4 ozs. No. 2, not *vice versa*.

In cases of over-exposure or weak negatives, it is advisable to use half new and half old developer, to give greater brilliancy. Development is complete when image appears fully out. After development and without washing, immerse the prints for about 2 minutes in clearing solution, pour off and repeat.

Clearing Solution.

Water	80 ozs.	1000 c.c.s.
Glacial acetic acid	½ oz.	6.5 ,,

Then wash thoroughly for about 10 minutes in several changes of water. All the acid must be removed, or fading of prints will result.

Fixing.

Water	20 ozs.	1000 c.c.s.
Hyposulphite of soda (avd.) ...	3 ,,	150 gms.

Allow 15 minutes for thorough fixation. Use fresh solution for each batch of prints.

After fixing, wash for 2 hours in running water or in frequent changes. Allow prints to dry naturally. Work with clean hands and clean dishes.

Ilford Formulæ in Metric Measures.

Ilford Plates.

Stock Solutions.

A.	Pyro	...28.4 gms. (1 oz.)
	Nitric acid	... 20 drops
	Water	... 150 c.c.s.
B.	Pyro	...28.4 gms.
	Potassium metabisulphite	... 5 ,,
	Water	... 150 c.c.s.

Working Solutions.

No. 1.	Stock solution of pyro A or B	25—50 c.c.s.
	Water to make up to	500 ,,
No. 2.	Sodium carbonate	50 gms.
	Sodium sulphite	50 ,,
	Potassium bromide	1.2 gm.
	Water to make up to	500 c.c.s.

Alum Bath.

Alum	... 30 gms.
Water	... 400 c.c.s.

Fixing.

Hypo	... 400 gms.
Water	...1000 c.c.s.

Ilford P.O.P.

Hardening Bath.

Alum ...	45	gms.
Common salt	30	,,
Water	600	c.c.s.

Toning.

No. 1.	Ammonium sulphocyanide	8	gms.
	Water	350	c.c.s.
No. 2.	Sodium sulphite	0.8	gm.
	Water	350	c.c.s.
No. 3.	Gold chloride (15 gr. tube)	1	gm.
	Water	425	c.c.s.

Fixing.

Hypo ...	75	gms.
Water ...	500	c.c.s.

Ilford Bromide Paper and Opals.

Developer.

No. 1.	Metol	4	gms.
	Hydroquinone	2	,,
	Sodium sulphite	35	,,
	Water up to ...	700	c.c.s.
No. 2.	Sodium carbonate ...	17½	gms.
	Potassium bromide	2.4	,,
	Water up to ...	700	c.c.s.

Fixing.

Hypo...	100	gms.
Water	500	c.c.s.

Developer.

No. 1.	Sulphate of iron	50	gms.
	Sulphuric acid	10	drops
	Warm water up to ...	200	c.c.s.
No. 2.	Potassium oxalate	200	gms.
	Potassium bromide	1	gm.
	Warm water up to ...	800	c.c.s.

Clearing Solution.

Glacial acetic acid...	10	c.c.s.
Water	1600	,,

Platona.—Ilford Platinum Paper.

Printing.

Printing frame and pad should be quite dry.

Print until all details are faintly visible. Examine in weak light only.

Developing Formula.—Stock Solution.

Potassium oxalate	2 ozs.
Potassium phosphate	½ oz.
Water	14 ozs.

This solution is better if slightly acid; if it is not so, 60 grs. oxalic acid should be added.

If unable to obtain potsssium phosphate, the sodium phosphate may be substituted, but the former is preferable.

Dissolve the salts in hot water and allow to cool. This solution will keep indefinitely.

For use, take 1 part stock solution and 1 part water.

Develop in weak artificial or diffused light, floating prints face downwards in the solution. The image does not lose in fixing.

Fixing.

Pure hydrochloric acid	1 oz.
Water	80 ozs.

Immerse prints for about five minutes each in three consecutive baths, and then give them a final washing in water for fifteen minutes.

The prints are then ready to be dried and mounted

KALONA.—THE ILFORD SELF-TONING PAPER.

The printing is done in the same way and to the same depth as with Ilford P.O.P.

The prints are then, without previous washing, slipped rapidly one by one face upwards into the following solution :—

Alum (powdered)	1½ oz.	30 gms.
Ammonium sulphocyanide ...	20 grs.	1 ,,
Water	20 ozs.	400 c.c.s.

They must be constantly turned over in the solution for five minutes to allow of an equal action on all parts. With very little practice a large number can be manipulated at the same time. The prints should next be washed for ten minutes in running water or repeated changes and fixed for ten minutes in a solution of—

Hypo	3 ozs.	75 gms.
Water	20 ,,	500 c.c.s.

They are then finally washed for two hours in the same way as Ilford P.O.P.

It will be found convenient to make up the bath from the following stock solutions, which will keep indefinitely :—

No. 1.

Alum (powdered)	8 ozs.	200 gms.
Water	100 ,,	2500 c.c.s.

No. 2

Ammonium sulphocyanide ..	100 grs.	8 gms.
Water	10 ozs.	350 c.c.s.

For use mix 18 ozs. of No. 1 with 2 ozs. of No 2.

It is essential to work with clean hands and dishes.

In tropical climates the following may be used instea of the ordinary formula :—

Ammonium sulphocyanide ...	20 grs.	2.3 gms.
Chrome alum	20 ,,	2.3 ,,
Water	20 ,,	1000 c.c.s.

The colour of the prints is not affected.

A fresh fixing bath should be used for each batch of prints, but care must be taken to have all the solutions as nearly alike in temperature as possible.

The alum and sulphocyanide solution *may* be omitted and the prints put into a solution of—

Common salt...	1 oz.
Water...	20 ozs.

for 5 minutes and then fixed, but the resulting tone is warmer than that obtained by the use of the sulphocyanide. It is, however, permanent. Prints treated in this way are not so suitable for enamelling.

Ilford Gaslight Paper and "Carbon Surface" Gaslight Paper.

Developer.

Metol	5 grs.	1 gm.
Sodium sulphite	½ oz.	50 gms.
Hydroquinone	20 grs.	4.6 ,,
Sodium carbonate (crystals) ...	½ oz.	50 ,,
10 % solution of potassium bromide	10 minims	2.5 c.c.s.
(Potass. bromide, 1 oz. ; water up to 10 ozs.)		
Water	10 ozs.	1000 ,,

To the 10 ozs. of warm (but not boiling) water add each salt, in succession, when the previous one is dissolved. It should be noted that a very minute quantity of potassium bromide is required. The developer should be clear and colourless when made, and will remain in good condition in a tightly corked or stoppered bottle for a considerable time, but it is unfit for use if it becomes discoloured.

The following Amidol Developer may be used for Ilford Bromide and Gaslight Papers :—

Amidol	20 grs.	4.6 gms.
Sodium sulphite...	½ oz.	50 ,,
Water	10 ,,	1000 c.c.s.
Potass bromide as required.		

The developer must be fresh and not discoloured. For bromide papers add 4 drops of a 10 per cent. solution of potass bromide to each ounce of developer ; for gaslight papers add 2 drops to each ounce.

"ILLINGWORTH" P.O.P.

For Rich Beautiful Tones of Dark Purple or Dark Brown.

Sulphocyanide of ammonium	15	grs.
Water...	20	ozs.
Dissolve and add chloride of gold	1½	grs.

For Red Tones add to the above Bath—

Sulphite soda	2	grs.
Water	20	,,

To Fix.—Wash the prints after toning, and then in the following bath, for *not less than ten minutes* :—

Hyposulphite of soda	2	ozs.
Water	20	,,

Combined Toning and Fixing Solution.

With this formula no washing is required before toning, the print being placed direct into the solution from the printing frame. It will keep and can be used soon after mixing :—

Hyposulphite of soda	2	ozs.
Acetate of lead	16	grs.
Chloride of gold	1	gr.
Common salt	1½	ozs.
Water	16	,,

Dissolve hypo and acetate of lead separately in warm water, using 8 ozs. of water for each, pour the lead acetate into the hypo solution, stirring vigorously, then add the salt and gold—allow sediment to settle before using.

Keep prints in solution until desired tone is obtained, being careful to keep prints in motion to prevent stains or marks.

Illingworth's Carbon Tissue.

The sensitising solution is made up in the proportion as follows :—

7 ozs. bichromate of potash.
1 gallon hot water.
3 drachms of liquid ammonia.

Allow to cool, and place in a convenient jar ; when cool it is ready for use, and can be used over and over again.

Illingworth's Bromide Papers.

Any of the ordinary developers for bromide papers can be used, but the following one solution developer is specially recommended :—

Amidol Developer.

Amidol	50	grs.
Sulphite of soda	600	,,
Bromide of potassium	10	,,
Water	20	ozs.

This developer must be used within three days after mixing.

To Fix.—Dissolve 5 ozs. of hyposulphite of soda in 20 ozs. of water, and allow the print to remain here for at least five minutes (longer will do no harm).

To obtain the most effective and brilliant prints we specially recommend the acid fixing bath :—

2 ozs. hyposulphite of soda.
1 oz. of acid solution.
20 ozs. of water.

Acid Solution.

This can be made up and kept as a stock solution. It will keep indefinitely :—

4 ozs. sulphite of soda.
½ oz. sulphuric acid.
20 ozs. water.

To Wash.—After fixation, the prints should be well washed in running water for at least one hour, and then hung up to dry, or laid face upwards on blotting paper, but not placed between blotting-paper.

ILLINGWORTH'S ZIGO PAPER.

Fixing.—The print changes colour as soon as placed in the "hypo" solution, and passes through the following tones :—

1st red. 2nd brown. 3rd purple.

When the desired tone is reached, remove print from the hypo solution and place in clean cold water, which must be constantly changed, or allowed to run for half an hour.

To Fix.—Place the prints direct, without previous washing, into one of the following solutions :—

For Brown or Purple Tones.

Hyposulphite of soda (hypo)	4 ozs. (4 table-spoonfuls)
Water	20 ,, (1 pint)

The above quantity will fix about 24 quarter plate prints, or 12 half plates.

It is advisable to dissolve the hypo in a little warm water, then make up the pint with cold water.

For Red Tones.

Take 10 ozs. (½ a pint) of above solution and make up with water to 20 ozs. (1 pint).

Note.—The prints should always remain in the hypo solution at least six minutes to become thoroughly fixed.

Note.—When a number of prints are fixed or washed at one time, is most important that they should be kept moving in the solution, and not allowed to stick together, otherwise stains and marks will result.

To Harden.—"Glossy" prints for enamelling must be hardened after washing by immersion in one of the following solutions :—

Alum...	2 ozs.
Water	20 ,, (1 pint)

Or—

Formalin (40 %)	1 oz.	
Water	20 ozs. (1 pint)	

Either of the above can be kept in a stock bottle and used over and over again; wash prints for about ten minutes after using above.

THE IMPERIAL COMPANY'S FORMULÆ.

"STANDARD" DEVELOPER.

No. 1.

Pyrogallic acid	55 grs.	6 gms.
Metol	45 ,,	5 ,,
Metabisulphite of potash ...	120 ,,	14 ,,
Bromide of potassium	20 ,,	2 ,,
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

No. 2.

Carbonate of soda (washing soda)	4 ozs.	200 gms.
Water (boiled or distilled) to...	20 ,,	1000 c.c.s.

For use take equal parts of No. 1 and No. 2.

"UNIVERSAL" DEVELOPER.

No. 1.

Metol	40 grs.	5 gms.
Hydroquinone	50 ,,	6 ,,
Sulphite of soda	120 ,,	14 ,,
Bromide of potassium	15 ,,	2 ,,
Water (boiled or distilled) to ..	20 ozs.	1000 c.c.s.

No. 2.

Caustic potash	180 grs.	21 gms.
Water (boiled or distilled) to ...	20 ozs.	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

PYRO-SODA DEVELOPER.

Stock Solution.

Pyrogallic acid	1 oz.	83 gms.
Bromide of potassium	60 grs.	13 ,,
Metabisulphite of potash ...	50 ,,	10 ,,
Water (boiled or distilled) to...	12 ozs.	1000 c.c.s.

No. 1.

Stock solution	3 ozs.	150 c.c.s.
Water (boiled or distilled) ...	20 ,,	1000 ,

No. 2.

Sulphite of soda	2 ozs.	100 gms
Carbonate of soda (washing soda)	2 ,,	100 ,,
Water (boiled or distilled) to ...	20 ,,	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

"Imperial" Metol Developer.

No. 1.

Metol	100 grs.	11.4 gms.
Metabisulphite of potash ...	10 ,,	1 gm.
Bromide of potassium	20 ,,	2 gms.
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

No. 2.

Sulphite of soda...	2 ozs.	100 gms.
Carbonate of soda	2 ,,	100 ,,
Water (boiled or distilled) to...	20 ,,	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

Hydroquinone Developer.

No. 1.

Hydroquinone	150 grs.	16 gms.
Metabisulphite of potash ...	10 ,,	1 gm.
Bromide of potassium	50 ,,	6 gms.
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

No. 2.

Sulphite of soda...	2 ozs.	100 gms.
Caustic soda	100 grs.	11 ,,
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

For use, take equal parts of No. 1 and No. 2.

After using this developer, always rinse the negative well before transferring to the fixing bath.

Single-solution Developer.

Metol	50 grs.	5.5 gms.
Hydroquinone	40 ,,	4.5 ,,
Sulphite of soda...	500 ,,	57 ,,
Bromide of potassium	25 ,,	3 ,,
Carbonate of soda	500 ,,	57 ,,
Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.

Imperial P.O.P.

Directions for Use.

Hard negatives should be printed in strong light, delicate negatives only in the shade.

Prints should be rather darker than the finished picture is desired

We specially recommend the following bath and mode of procedure for excellence and uniformity of result.

After printing, wash thoroughly for 10 to 15 minutes in running water before immersion in the toning solution.

In hot weather, if the surface of the prints become soft, immerse, after washing, in an alum bath (alum 1 oz., water 10 ozs.), leave for 10 minutes, wash again in running water for 5 to 10 minutes and place in the following toning bath.

Sulphocyanide Toning Bath.

Stock Gold Solution.

	Chloride of gold	15 grs.	18 gms.
	Water (distilled or boiled) to...	15 drachms	1000 c.c.s.
No. 1.	Sulphocyanide of ammonium...	75 grs.	8.5 gms.
	Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.
No. 2.	Stock gold solution	5 drachms	31 ,,
	Water to	20 ozs.	1000 ,,

For use, take equal quantities of No. 1 and No. 2.

Add solution No. 2 slowly to solution No. 1, stirring all the time. Make up the solutions exactly as above, and follow out the instructions carefully.

The prints should tone in 5 to 10 minutes.

When toning has been judged sufficient, wash for about 5 minutes and transfer to the following fixing bath—

Hyposulphite of soda	3 ozs.	150 gms.
Water to...	20 ,,	1000 c.c s.

After fixation is complete (about 10 minutes), wash thoroughly for 1 hour.

THE KODAK COMPANY'S FORMULÆ.

For Kodak Film, Kodoid Film, and Premo Film Pack.

A.	Metol	60 grs.	2 gms.
	Hydroquinone	30 ,,	3.5 ,,
	Sulphite soda (crystals) ...	$1\frac{1}{2}$ ozs.	75 ,,
	Water	20 ,,	1000 c.c.s.
B.	Carbonate soda (crystals) ...	1 oz.	50 gms.
	Water	20 ozs.	1000 c.c s.

To Develop.

Take A solution 1 oz., soda solution 1 oz., water 2 ozs. Add 1 or 2 drops 10 per cent. solution potassium bromide to each oz. of developer.

Acid Fixing Bath.

Hypo	4 ozs.	500 c.c.s.
Water	16 ,,	125 gms.
Soda sulphite (cryst.)	160 grs.	10 ,,

When fully dissolved, add the following hardener—

Powdered alum	60 grs.	4 gms.
Citric acid	60 ,,	4 ,,

This bath may be made up for future use and may be used as long as it retains its strength. If plain hypo bath be used, the negatives must be rinsed in three changes of water and transferred to a saturated solution of common alum for about 5 minutes, then thoroughly washed.

Pyro Formulæ.

For Film-pack.

A.	Pyrogallic acid...	1 oz.	30 gms.
	Sulphuric acid	20 minims	1 c.c.
	Water	28 ozs.	900 c.c.s.
B.	Sulphite soda (crystals) ...	6 ,,	180 gms.
	Carbonate soda (crystals) ...	4 ,,	120 ,,
	Water	28 ,,	900 c.c.s.

To develop take A solution 1 oz., soda solution 1 oz., water 8 ozs.

For Kodoids.

A.	Pyro	½ oz.	15 gms.
	Sodium sulphite	6 ozs.	190 ,,
	Sulphuric acid	20 minims	1 c.c.
	Water	32 ozs.	1000 c.c.s.
B.	Sodium carbonate	4 ,,	120 gms.
	Water	32 ,,	1000 c.c.s.

To develop, take pyro solution 1 oz., soda solution 1 oz., water 2 ozs.

For Seed Plates.

Pyro Developer.

No. 1.	Water	16 ozs.*	1000 c.c.s.
	Sulphite of soda (crystals) ...	4 ,,	240 gms.
	Pyrogallic acid	1 oz.	60 ,,
	Sulphuric acid	5 drops	
No. 2.	Water	16 ozs.	1000 c.c.s.
	Carbonate of soda (crystals) ...	4 ,,	240 gms.

To develop, take No. 1, 1 oz.; No. 2, 1 oz.; water, 8 ozs.

If negatives are too grey, take 3½ ozs. of sulphite of soda instead of 4 ozs. If too yellow, take 4½ ozs., that is if the yellowness is not due to discoloured fixing bath.

A. B. C. Pyro Developer.

A.	Water to make up to	8 ozs.	500 c.c.s.
	Sulphite of soda (crystals) ...	½ oz.	30 gms.
	Pyro	1 ,,	60 ,,
	Citric acid	10 grs.	1 gm.
B.	Water	16 ozs.	1000 c.c.s.
	Sulphite of soda (crystals) ...	4 ,,	240 gms.
C.	Water	16 ,,	1000 c.c.s.
	Carbonate of soda (crystals) ...	4 ,,	240 gms.

To develop, take A, ½ oz.; B, 1 oz.; C, 1 oz.; †water, 8 ozs.

Less of B will give a warmer tone to negative. If negatives are too yellow, use more of B.

The best printing colour is a brownish black, but for this colour do not carry development quite so far as you may have done when

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* For double coated plates use 18 ozs. water.

you obtained a bluish or greyish black. These latter colours should be avoided.

Kodak Solio and Matte Solio Printing Out Papers.

Printing.—Should be done in a strong light if the negatives are hard, only thin and delicate negatives being printed in the shade. The printing should be carried only a little darker than the finished print is required, as the paper loses very little in the subsequent toning and fixing operations.

Toning.—Separate toning bath (sulphocyanide).

By adopting the following method of toning Eastman's Solio P.O.P, any desired tone may be obtained, from a red-brown to a purple-black, and the system ensures both economy in the use of gold, and great uniformity of colour throughout any number of prints. It is based on the principle of allowing a definite amount of gold to a definite number of prints or area of printed paper.

Prepare the following—

Stock Solution.

Chloride of gold	15 grs. (one tube)
Sulphocyanide ammonium ...	150 ,,
Water to	30 ozs.

The sulphocyanide should be dissolved first and the gold added afterwards. Each oz. contains ½ gr. of chloride of gold.

To impart to a 1s. packet of paper a cold purple-black tone take 6 ozs. of the stock solution and dilute with water to measure, say, 30 ozs. Treat all the prints at the same time, and allow them to remain in the bath for 8 minutes, keeping them in motion as usual in toning.

For a purple-brown colour a packet of paper requires 3 ozs. of stock solution, or for a brown colour 1½ ozs. of stock solution, whilst 1 oz. of stock solution will give a red tone.

If it is required to tone less than a packet of paper, a proportionate reduction must be made in the amount of stock solution.

The amount of water to be added to the stock solution is in all cases just as much as is considered necessary for conveniently handling the prints.

Mix the bath to the desired strength and in the desired quantity. Wash the batch of prints well for 10 minutes in running water (or in three changes of water). Transfer as rapidly as possible the whole of them, one by one, to the toning bath.

Tone for 8 or 10 minutes, moving the prints all the time.

Rinse well.

Fix for 10 minutes in the following fixing bath :—

Sodium hyposulphite	3 ozs.
Water up to...	1 pint

If the weather is warm and the surface of prints becomes soft, immerse for 5 minutes in alum bath (alum 2 ozs., water 1 pint), having given them 10 minutes to wash after fixing.

Wash for one hour in running water, or in ten changes, keeping the prints moving 2 or 3 minutes in each,

For those who prefer a combined toning and fixing bath we give the following formula :—

The tones obtainable are from red to dark brown.

Printing must be carried decidedly darker than the finished pictures should appear.

Stock Solutions.

No. 1.	Hypo, 12 ozs. dissolved in water and made up to 2 pints.			
No. 2.	Ammonium sulphocyanide, ½ oz.	,,	,,	5 ozs.
No. 3.	Lead acetate, ¼ oz.	,,	,,	5 ,,
No. 4.	Gold, 15 grs.	,,	,,	5 ,,

Take of No. 1, 7 ozs. ; No. 2, 1 oz. ; No. 3, 1 oz. : No. 4, ½ oz.

Wash thoroughly, tone and fix in the above bath, and finally wash in running water for about one hour.

Caution.—The combined toning and fixing baths should not be used for postcards and other thick papers. They should be toned in the separate bath, then very thoroughly fixed and washed for one and a half hour in running water, or fifteen changes.

Matte Solio Paper.

All the foregoing directions apply also to the treatment of Matte Solio, but the toning bath which we specially recommend for Matte Solio is the following :—

Sepia Tones—Stock Solution.

Potassium chloroplatinite	5 grs.
Citric acid	40 ,,
Sodium chloride (salt)	40 ,,
Water...	20 ozs.

This bath keeps well for a month.

Wash the prints from 5 to 10 minutes, and then immerse in the above bath, examining the prints by transmitted light.

Tone to a dark brown or chocolate colour (not black), rinse slightly, and immerse the prints in the following bath to stop the toning action :—

Sodium carbonate (washing soda)	½ oz.
Water	20 ozs.

Rinse and transfer to the following fixing bath :—

Sodium hyposulphite	3 ozs.
Water	20 ,,

Wash thoroughly in running water or by frequent changes for one hour.

Should it be thought desirable to specially harden the gelatine, use an alum bath as follows :—After fixing the prints, wash them well from 10 to 15 minutes, and then immerse for not more than 5 minutes in—

Alum...	½ oz.
Water	20 ozs.

and finally wash thoroughly.

RAPID PRINTING PROCESS, BY DEVELOPMENT, OF SOLIO.

Print until the image shows distinct detail in all but the high lights.

Developer.—Develop with the following developer until the prints look similar to printed out prints, but rather more brown in colour ; this should take 5 or 6 minutes.

Hydroquinone	24 grs.
Citric acid	60 ,,
Acetate soda	1½ oz.
Water	30 ozs.

As soon as the prints are dark enough transfer them to a dish containing plenty of clear water (running water if possible), and allow them to wash for about 15 minutes. The prints will continue to develop very slightly when first transferred to the washing water, and for this reason care should be taken not to develop them too dark. Then tone in the sulphocyanide or combined toning and fixing bath in the usual way.

A little extra care should be exercised in putting Solio intended for development into the frames, and taking it therefrom. It should be done in subdued daylight. Development is best done by ordinary lamplight without a yellow shade. Prints made by this process are even more brilliant, and show more detail than those fully printed out.

KODAK SELF-TONING SOLIO PAPER (Matte and Glossy).

Print slightly deeper than the finished print is required.

Put the prints, without previous washing, into the following bath, and keep them moving for 3 to 5 minutes :—

Ammonium sulphocyanide ...	20 grs.	2 gms.
Water	20 ozs.	1000 c.c.s.

Wash for 5 minutes in running water, or several changes, and fix in—

Hypo	3 ozs.	150 gms.
Water	20 ozs.	1000 c.c.s.

for 10 minutes. Then wash in running water for one hour, or in fifteen to sixteen changes.

The following alternative bath will give good warm tones on both grades of paper, but is specially recommended for Matte. Put the prints, without previous washing, into the following bath :—

Salt	1 oz.	50 gms.
Water	20 ,,	1000 c.c.s.

for 5 minutes, and then place in the above fixing bath.

KODAK COLLODIO CHLORIDE PAPER.

Directions.

MATTE.

The printing of Matte collodio chloride for platinum tones should be very deep, and, as a general thing, it should be printed without

vignetting. Print until the high lights are well tinted. Pay no attention to the shadows, no matter how much they bronze, as that will all tone out. Prints should be washed in six changes of clear water, moving them about in each change; unless the prints are thoroughly washed they will not tone evenly. When the prints are sufficiently washed and ready to tone, they are first placed in a plain gold bath, made alkaline with borax, enough to turn red litmus paper blue in one minute.

Gold chloride	1 gr.
Water	30 ozs.

Add sufficient of a saturated solution of borax to make bath very slightly alkaline (about 25 to 30 drops)

Tone in this bath to chocolate brown in the deepest shadows by transmitted light. The gold toning bath should be made up from 4 to 5 hours before use. Add gold enough to keep the speed of the bath 6 to 8 minutes. If the prints show bleaching in the half-tones before the shadows are toned far enough, add more borax. The alkali acts as a restrainer on the half-tones. The amount to use is the amount necessary to hold the half-tones from bleaching while the shadows tone. When the prints are toned, place in clear water; and when all are toned, wash in three changes of water and tone in the following platinum bath:—

Potassium chloroplatinite...	4 grs.
Citric acid	100 ,,
Water	30 ozs.

This bath should be made up an hour before use, and, in cold weather or when the water used is cold, the chill should be taken off the bath with a little warm water. The prints should be toned in this bath until all trace of red or brown is out of the deepest shadows. When prints are toned in the platinum bath, place in clear water, and when all are toned wash in three changes of water, moving them about by hand in each. After prints are washed, fix in hyposulphite of soda bath, 1 oz. of crystals to 16 ozs. of water, for 15 minutes, moving the prints while fixing. After prints are fixed, wash from an hour to an hour and a half in running water, or 10 to 12 changes, by hand.

Glossy.

Printing.—Print considerably darker than desired when finished and after washing tone in the following bath:—Water 60 ozs., kodak gold solution 2 drachms (or, if dry chloride of gold is used, 2 grains) and ½ drachm of dry acetate of soda. Add a few drops of saturated solution of borax, enough to make the bath slightly alkaline. Allow to stand 2 or 3 hours before using. It is a good plan to save this bath from day to day and use part old and part new each time. If the prints fail to clear up, leaving muddy half-tones, too much alkali has been used. If the prints bleach and turn blue in the half-tones, while the shadows remain red, not enough alkali has been used.

For Dark Tones.—We submit the following bath for those desiring

deep blue or black tones. This bath can be renewed two or three times by the addition of gold.

Water	32 ozs.
Sulphocyanide of ammonium	½ oz.
Gold chloride	2 grs.

Fixing.—Fix in hypo bath, 1 oz. hypo to every 16 ozs. of water. Have plenty of bath to cover prints nicely, and separate thoroughly. 15 or 20 minutes will be sufficient time.

Final Washing.—Finally, wash thoroughly. It is the frequent and complete change of water that washes the hypo from a print, not continuous soaking. One hour in running water that changes completely every few minutes is sufficient, or seven or eight changes of water if prints are washed by hand.

Kodak Aristo-Junior Paper.

After thoroughly washing prints, tone in the following bath :—

Gold Bath.

Water	60 ozs.	1700 c.c.s.
Salt	20 grs.	1.3 gm.
Saturated solution sodium acetate...	½ oz.	14 c.c.s.
Aristo gold No. 2	1 drachm	3.5 ,,

Add of a saturated solution of carbonate of soda or borax, enough to turn red litmus paper blue in 1 to 2 minutes. Make this bath up from 4 to 5 hours before use. Add gold enough to keep speed of bath 6 to 8 minutes.

Tone in this bath to any point you desire prints when finished. After toning, place in clear water. After prints are all toned, wash through two waters and then fix in plain hypo bath for 15 minutes—1 oz. of hypo and 16 ozs. of water. Wash by hand through 12 changes of water or 1 hour in running water.

Aristo Platino and Platinum Tones.

Printing.—Print until the high lights are well tinted; pay no attention to the shadows, no matter how much they bronze, as that will all tone out.

Washing.—Prints should be thoroughly washed before toning in 6 changes of clear water. Unless prints are well washed they will not tone evenly. In cold weather use enough warm water in all wash water and baths to take the chill off, and keep the water at a temperature of from 65 to 70 degrees F.

When prints are sufficiently washed, tone in the following gold bath :—

Gold Bath.

Water	60 ozs.	1700 c.c.s.
Salt	15 grs.	1 gm.
Gold chloride	4 ,,	.26 ,,

Add a saturated solution of crystal borax (dissolved in hot water), enough to turn red litmus paper blue in half a minute.

Tone in this bath to a deep chocolate brown in the deepest shadows by transmitted light; add gold enough to keep the speed of the bath 6 to 8 minutes. If the prints show any bleaching of the high lights before the shadows are toned far enough add more borax. The alkali (borax) acts as a restrainer on the high lights, and use an amount necessary to hold the whites from bleaching while the shadows tone; when the prints are toned, place them in clear water, and when all are toned, wash through 3 changes of water, and tone in the following platinum bath:—

Water	60 ozs.	1700 c.c.s.
Aristo platinum solution ...	3—5 drachms	10—18 ,,

Add platinum solution enough to keep speed of the bath 8 to 10 minutes. This bath should be made up an hour before use; keep this bath at a temperature of 65 to 70 degrees F. The prints should be toned in this bath until all trace of red or brown is out of the deepest shadows. When the prints first go into this bath, the whites are muddy, but in a short time they commence to clear, and by keeping the prints in this bath until the whites are thoroughly clear, and every trace of red or brown is out of the deepest shadows viewed by transmitted light, the most beautiful carbon effects will be produced. After the platinum bath, wash in 3 changes of water, handling them over by hand in each. After prints are washed, fix in:—hyposulphite of soda, 1 oz. crystals to 16 ozs. of water, for 12 to 15 minutes, moving the prints while fixing.

When prints are fixed, place direct from the hypo bath into strong salt solution (10 to 12 ozs. of table salt to each gallon of water), handle prints in this salt water for 5 minutes, and then wash through 10 changes of water, or about an hour and a half in running water.

Kodak Bromide Papers, Permanent, Platino-Matte, Royal, White Royal and Nikko.

Metol-Hydroquinone Developer.

Metol	8 grs.	.9 gm.
Hydroquinone	30 ,,	3.5 gms.
Sodium sulphite (cryst.) ...	$\frac{3}{4}$ oz.	36 ,,
Sodium carbonate (cryst.) ...	$\frac{3}{4}$,,	36 ,,
10 % solution of potassium bromide	20 minims	2 c.c.s.
Water	20 ozs.	1000 ,,

Amidol Developer.

Amidol	60 grs.	1.8 gm.
Sodium sulphite (cryst.) ...	1 oz.	50 gms.
10 % solution potassium bromide	20 drops	2 c.c.s.
Water	20 ozs.	1000 ,,

This bath should only be made up immediately before use.

After exposure the paper should be soaked for a minute in water, and then flooded with the developer. The picture will appear almost immediately. When sufficiently developed the print should be

washed in 3 or 4 changes of water, and then immersed for 10 minutes in the following fixing bath :—

Sodium hyposulphite	4 ozs.	200 gms.
Water	20 ,,	1000 ,,

After fixing, wash thoroughly in several changes of water for two hours at least, and hang up to dry.

Sepia Toning Formula.

Sodium hyposulphite	10 ozs.
Alum	1 oz.
Boiling water	70 ozs.

Dissolve the hypo in the water, and then add the alum slowly. When all is dissolved the solution should be milk white. This solution should not be filtered, and it works better as it becomes older ; it may be strengthened from time to time with a little fresh solution. Never throw the bath away entirely, but replenish it in the manner stated. The best results are obtained on prints developed by the above amidol formula, and by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes.

Alum Bath.

When this toning bath is to be employed, the use of the alum bath after fixing is absolutely essential. Moreover, the prints should not, in this case, be subjected to a prolonged washing, but should only be slightly rinsed before being dried. A new bath tends to reduce the prints rather more than an older one. When toned, the prints should be placed in a tepid solution of—

Water	70 ozs.
Alum	2 ,,

then washed thoroughly.

Kodak Dekko Paper.

The metol-hydroquinone developer given above for Kodak bromide papers will be found to work well if the chemicals are dissolved *in* 10 *instead of* 20 *ozs. of water.* It is of the utmost importance that the developer should contain the full amount of bromide, for without it the paper will not produce clear whites.

When developed, rinse quickly and immerse in the following fixing bath :—

Hyposulphite of soda	4 ozs.	120 gms.
Alum	1 oz.	30 ,,
Water	16 ozs.	450 c.c.s.

Fix for 15 minutes, keeping the prints separated. When fixed, transfer to the washing tray.

Kodak Platinum Paper.

Directions.

Developing.—The developer is simply neutral potassium oxalate and water ; 2 ozs. of neutral patassium oxalate dissolved in 10 fluid

ozs. of water. If tones more on the blue black are desired, use the following developer:—water, 10 ozs.; potassium oxalate, 1 oz.; potassium phosphate, ½ oz. In preparing developer containing potassium phosphate, always use warm water, as this chemical does not dissolve freely in cold water.

Clearing Bath.—As soon as prints are fully developed they are placed faced down directly into a clearing bath of hydrochloric acid and water; 1 oz. of pure hydrochloric acid to 60 ozs. of water.

LETO PHOTO-MATERIALS CO., LTD.

Leto-Collodio Chloride Paper.

Toning Bath.

Solution A.

Water (distilled preferable) ...	30 ozs.	850 c.c.s.
Acetate of soda cryst.... ...	2½ ,,	750 gms.

Solution B.

Water (distilled preferable) ...	6 ozs.	170 c.c.s.
Sulphocyanide of ammonia ...	¼ oz.	7 gms.

For use, take of :—

Solution A	12½ ozs.	125 c.c.s.
Solution B	1 oz.	10 ,,
Chloride of gold	5 gr.	:1 gm.
Water or old bath	8—10 ozs.	80—100 c.c.s.

When toned rinse the prints in 2 to 3 changes of clean water.

Seltona Self-toning Paper.

Directions for Use.

For Warm Brown Tones.

Soak the prints for a minute or two in clean water, and place in the fixing bath as follows:—

Hypo	2 ozs.	100 gms.
Water	20 ,,	1000 c.c.s.

Fix for about 10 minutes, then wash for 1 hour in running water or 8 to 10 changes.

Dark Brown, Purple and Blue Tones.

Soak the prints for a minute or two in clean water, and place for 7 to 10 minutes in the following :—

Common salt	1 oz.
Water...	12 ozs.

(or 4 good tea-spoonfuls to ½ pint water).

A stronger solution may be employed if desired.

Rinse in clean water and fix as above.

Darker and Bluer Tones are obtained by placing the prints *direct* into the salt solution without previous washing.

A stronger solution of salt up to 2 ozs. in 10 ozs. may be employed if desired.

Leto Platino-Matt.

For Brown-Black and Warm-Black Tones.

Printing.—Print very deeply, until the shadows develop a distinct bronze tinge, as the prints lose considerably during the toning process.

Washing.—It is most important that this should be done thoroughly. Wash in several changes until the last washing water is perfectly clear.

Toning.—The prints are first partly toned in the following gold bath. Toning must not be carried on too far, but only until the prints seem to have changed colour. A long immersion will yield blue-black and a short immersion brown-black tones in the subsequent platinum bath.

Shortly before use only, make up as follows :—

Water	17 ozs.	530 c.c.s.
Acetate of soda	1 oz.	30 gms.
Gold chloride	1 gr.	·065 ,,

After toning, wash for a minute or two, and continue in the following platinum bath, until the desired effect has been obtained. (This bath may be used over and over again until exhausted, when a fresh bath must be made up.)

Water	9 ozs.	250 c.c.s.
Phosphoric acid...	2 drachms	7.1 ,,
Chloroplatinite of potash ...	7½ grs.	.48 gms.

Then wash in 2 to 3 changes of water.

Fixing.—Fix for 10 minutes in hypo 1 oz. ; water 20 ozs.

Final Washing.—For at least 1 hour in running water or 8 to 10 changes.

Drying.—Damp off the moisture between clean blotting-paper and allow the prints to dry spontaneously, or they may be dried before the fire.

Rich Sepia and Red-Brown Tones.

Rich sepia and red-brown tones are obtained by diluting the above solutions with an equal quantity of water, and proceeding in the same way as for black tones.

Toning in the gold bath must only be carried on until the high lights are clear.

In the platinum bath the prints must only be immersed for a few moments and then fixed as usual.

Printing must not be carried on too far.

Platinum Toning Without Gold.

Water	40 ozs.	1000 c.c.s.
Chloroplatinite of potassium...	15 grs.	.9 gm.
Oxalic acid	150 grs.	9.2 gms.
Hydrochloric acid, chem. pure	75 minims	4.5 c.c.s.

The prints, which must be deeply printed, until the high lights are well out, are first thoroughly well washed in several changes as usual, and toned in the above platinum bath. The prints are judged by transmitted light, and toned until they appear a uniform grey. (Toning takes 5 to 8 minutes.)

For more plastic effects, in place of the above, the following platinum bath can be employed :—Water, 25 ozs.; phosphoric acid dil. B. P., 230 minims ; chloroplatinite of potassium, 15 grs.

Both the above platinum baths keep indefinitely and can be used over and over again until exhausted, but must be filtered each time after use. So soon as the action of the bath is too slow it is advisable to add a further quantity of fresh solution. The best results are obtainable by mixing half old or used solution with half fresh.

Leto-Gaslight Paper.

Developers.

Adurol.

For Brown-Black Tones.

Adurol-Schering	$\frac{1}{4}$ oz.
Soda sulphite, cryst.	2 ozs.
Water	12½ ,,

Soda carbonate	1½ oz.
Water	12½ ozs.

Shortly before use mix equal parts of each.

Metol-Hydrokinone.

For Pure Black Tones.

Water	10 ozs.
Soda carbonate	1½ oz.
Soda sulphite, cryst.	$\frac{1}{4}$,,
Metol	10 grs.
Hydrokinone	30 ,,
Pot. bromide (10% solution)	4 minims

For correct exposure development should be complete in 10 to 30 seconds.

It is advisable to give plenty of exposure and develop quickly. When fully developed rinse and fix in an acid fixing bath for about 10 minutes and wash for 1 hour in several changes or running water.

LUMIERE'S FORMULÆ.

Pyro Developer.

No. 1.

Water	15 ozs.	300 c.c.s.
Pyro	1 oz.	20 gms.
Soda sulphite	3 ozs.	60 ,,
Nitric acid	30 minims	1.4 c.c.s.

No. 2.

Water	15 ozs.	300 c.c.s.
Soda carbonate	4 ,,	75 gms.
Soda sulphite	3 ,,	60 ,,

For use take

Water	1 oz.	60 parts
No. 1 solution	1 drachm	6 ,,
No. 2 solution	1—1½ drachms	6—10 ,,

DIANOL (Diamidophenol).

Water	1000 c.c.s.
Anhydrous soda sulphite	30 gms.
Dianol	5 ,,

This solution should be used quite fresh.

A stock solution of the soda sulphite and water may be made and the dianol added dry in proportionate quantity at time of using.

Lumiere's Citrate P.O.P.

GLOSSY AND MATT (Mauve).

Any of the ordinary toning methods may be employed, but the makers specially recommend the use of the following combined toning and fixing bath, the results obtained with which cannot be beaten for beauty or permanence.

A.

Warm water	20 ozs.	1000 c.c.s.
Hyposulphite of soda	7 ,,	400 gms.
Alum	170 grs.	20 ,,
Lead acetate	17 ,,	2 ,,
Citric acid	17 ,,	2 ,,

Dissolve the hyposulphite, citric acid, and alum, and when cold add the lead acetate. Allow to stand for several hours, and then filter carefully.

B.

Water	3½ ozs.	100 c.c.s.
Gold chloride	15 grs.	1 gm.

To 100 parts of A add from 6 to 8 parts of B, according to tone required.

Printing should be carried on till about one-third darker than ordinary albumen paper.

Before toning wash for 10 minutes in frequently changed water.

Afterwards wash for 2 hours in several changes of water.

For those who prefer the separate baths we give the following formula :—

Distilled water	20 ozs.	1000 c.c.s.
Refined chalk	45 grs.	5 gms.
1 per cent. solution of gold chloride	2 ,,	100 c.c.s.

Allow to stand for 24 hours, then filter, and for use add 15 parts of above bath to 100 parts of water.

After toning, rinse prints and transfer to a 1 per cent. solution of alum for a few minutes, wash well, and fix in :—

Fixing Bath.

Water	20 ozs.	1000 c.c.s.
Hyposulphite of soda	3 ,,	150 gms.
Soda bisulphite	1½ drachms	6 ,,
Alum	30 grs.	4 ,,
1 per cent. solution of lead nitrate	2 drachms	15 c.c.s.

In this bath the prints will turn to a yellowish red, but will then change rapidly through brown to blue. Take the prints from the bath when the desired tone is obtained, and wash, preferably in running water.

For use with the matt paper, the following platinum bath will be found to produce tones of great beauty—

Water	20 ozs.	500 c.c.s.
Salt	30 grs.	2 gms.
Potass chloroplatinite	15 ,,	1 gm.

First wash for 10 minutes, then tone till the print appears black, wash in several changes of water, and fix in the combined toning and fixing bath before given.

To obtain platinum black tones, add to the platinum bath a few minims of a 1 per cent. solution of gold chloride.

Lumiere's Porcelain Paper.

Matt. Mark F.

The developer recommended is as follows :—

Water	20 ozs.	1000 c.c.s.
Anhydrous sulphite of soda...	170 grs.	20 gms.
Diamidophenol	45 ,,	5 ,,
10% solution of pot. bromide	20—50 minims	2—5 c.c.s.

This solution is best prepared fresh for each batch of prints, but if desired the soda solution can be made in bulk, and diamidophenol added in proportionate quantities as wanted.

Exposure will vary according to negative density, distance from light, and power of illuminant; and a trial exposure on a small portion of paper will be the most reliable working guide.

Lumiere's Bromide Papers.

For Contact Printing.

Mark A. Matt Surface.
Mark C. Glossy.

These papers are specially prepared for print-making by contact.

Development and fixing are carried out by the usual methods. The developer most recommended is as follows :—

Water	20 ozs.	1000 c.c.s.
Anhydrous soda sulphite ...	170 grs.	20 gms.
Dianol	45 ,,	5 ,,
10% solution of pot. bromide	20—50 minims	2—5 c.c.s.

This developer should be freshly made for each batch of prints, but should it be desired, the soda solution can be made in bulk, and the diamidophenol added at the time of use.

Exposure: 5 to 10 seconds to an ordinary gas burner with a negative of average density, according to distance from flame.

Fixing and Washing.—The prints, when removed from the developer, should be well rinsed and then fixed for 5 or 6 minutes in the following :—

Fixing Bath.

Water	1000 parts.
Hyposulphite of soda	200 ,,
Soda bisulphite	100 ,,
Alum	2 ,,

After fixing, wash prints thoroughly and hang up to dry.

MARION'S FORMULÆ.

Developers for "Marion" Plates.

For portraiture the following is recommended :—

Pyro Stock Solution.

Pyrogallic acid	1 oz.	50 gms.
Sodium sulphite	8 ozs.	400 ,,
Sulphuric acid	1 drachm	6 c.c.s.
Water to make up	20 ozs.	1000 ,,

Soda Stock Solution.

Sodium carbonate (cryst.) ...	8 ozs.	400 gms.
Potassium bromide	1 drachm	7 ,,
Water to make up	20 ozs.	1000 c.c.s.

For Development.

Five ozs. (250 c.c.s.) of each stock solution made up separately to 20 ozs. (1000 c.c.s.) with water and mixed in equal parts at the time of using. When very soft negatives are required—or only a minimum of exposure can be given—the bromide of potassium may be omitted.

Pyro-Ammonia.

Pyrogallic acid	1 oz.	100 gms.
Ammonium bromide	1 ,,	100 ,,
Citric acid	1 drachm	12 ,,
Water to make up	10 ozs.	1000 c.c.s.

Ammonia.

Strongest liquid ammonia (.880)	1½ oz.	150 c.c.s.
Water to make up	10 ozs.	1000 c.c.s.

Two ozs. (200 c.c.s.) of each of above separately made with water to 20 ozs. (1000 c.c.s.) form the solutions for use, equal parts being mixed together at the time of development.

Metol and Hydroquinone.

Metol	50 grs.	6 gms.
Hydroquinone	50 ,,	6 ,,
Sodium sulphite	700 ,,	80 ,,
Potassium bromide	5 ,,	1 gm.
Citric acid	5 ,,	1 ,,
Water to	20 ozs.	1000 c.c.s.
Potass carbonate	2 ,,	100 gms.
Water to	20 ,,	1000 c.c.s.

Equal parts being mixed at time of use.

For Gelatino-Chloride Plates.

Iron.

For Cold Tones.

No. 1. Potass citrate	100 grs.	230 gms.
Potass oxalate	30 ,,	69 ,,
Hot distilled water to make up to	1 oz.	1000 c.c.s.

For Warm Tones.

No. 2. Citric acid	90 grs.	206 gms.
Ammonium carbonate	60 ,,	137 ,,
Cold distilled water to make up to	1 oz.	1000 c.c.s.

For Extra Warm Tones.

No. 3. Citric acid	130 grs.	297 gms.
Ammonium carbonate	40 ,,	92 ,,
Cold distilled water to make up to	1 oz.	1000 c.c.s.

In mixing the solutions Nos. 2 and 3, it is better to place the crystals of the salts into a deep vessel, and, after adding the water, leave alone till all effervescence ceases. It is advisable to make it over night.

To three parts of either of the above add one part of the following at the time of using :—

Sulphate of iron	120 grs.	275 gms.
Sulphuric acid	1 drop	2 c.c.s.
Make up with distilled water to	1 oz.	1000 c.c.s.

Either of these developers should give clear glass in the unexposed parts of the picture ; but, if at any time the slightest fog is found, it

should at once be cured by the addition of a trace of either potassium bromide or sodium chloride. Bromide is better with No. 1, and chloride with either No. 2 or No. 3. A convenient form of using these will be to keep a 10 per cent. solution of each of these salts, and 1 or 2 minims to each oz. of developer will be found a powerful restrainer.

HYDROQUINONE.

No. 1.	Hydroquinone	48 grs.	11 gms.
	Sodium sulphite	320 ,,	73 ,,
	Ammonium bromide	2 ,,	0.5 gm.
	Water to make up to	10 oz.	1000 c.c.s.
No. 2.	Ammonium carbonate... ...	100 grs.	23 gms.
	Sodium carbonate	100 ,,	23 ,,
	Water to make up to	10 ozs.	1000 c.c.s.

Equal proportions of each are mixed together, according to size of plate to be developed at the time of using.

Different alkalies may be substituted for those mentioned, such as potassium carbonate, sodium silicate, potassium hydrate, sodium hydrate, etc.; but, in all cases, a small proportion of bromide should be used.

A number of plates may be developed one after the other in the same solution.

MARIONA PAPER (P.O.P)

Directions.—Print as with albumenised papers, slightly darker than required for the finished picture, or for partial development, as instructions below.

Washing.—After printing, wash thoroughly in several changes of water from 10 to 15 minutes.

Toning.—This paper may be toned with any of the usual baths, but the following are recommended :—

PLATINUM TONING.—FOR SEPIA TONES.

Stock Solutions.

A. Potassium chloroplatinite, 15 grs. (2.3 gms.) in 15 ozs (1000 c.c.s.) of water, to which have been previously added 5 minims (½ c.c.) of hydrochloric acid.

B.	Citric acid	160 grs.	46 gms.
	Chloride sodium	160 ,,	46 ,,
	Water	8 ozs.	1000 c.c.s.

Take equal parts of A and B, and dilute with water to 4 or 6 times the bulk, according to speed of toning desired.

GOLD TONING.—CARBONATE BATH.

A. Stock solution of gold chloride, 15 gr. tube in 15 ozs. of water (2.3 gms. per litre).

B. Sodium carbonate (common washing soda), 30 grs. in 15 ozs. of water (4½ gms. per litre).

Take according to requirements equal parts of A and B, and dilute

with water, to 4 or 6 times the bulk according to speed of toning desired.

GOLD TONING.—SULPHOCYANIDE BATH.

A. Stock solution of gold chloride, 15 grs. in 15 ozs. of water (2.3 gms. per litre).

B. Stock solution of ammonium sulphocyanide containing 10 grs. to every oz. of water (35 gms. per litre).

For use, take 1 part of each and make up with water, to 8 or 12 times the bulk. The bath should be fresh every time.

Washing after Toning.—Thoroughly wash in several changes of water, and then place in the fixing bath.

Fixing Bath.—Dissolve 3 ozs. (150 gms.) of hypo in 1 pint of water (1000 c.c s.). Keep the prints moving for at least 10 minutes.

Final Washing.—In running water, or several changes of water, for at least 2 hours.

Alum Bath.—In warm weather or hot climates it is advisable to use this bath before toning; strength about 10 per cent., or chrome alum 1 per cent. for 10 minutes, prints being again thoroughly washed before toning.

Partial Development.—This method will be found very convenient in dull weather, or even at night by magnesium or electric light. Print till the image is fairly visible, then immerse without washing in a 10 per cent. solution of potassium bromide for 4 or 5 minutes. Then, after washing for a few minutes, place the print in the following developer mixed in equal proportions :—

A.	Hydroquinone	80 grs.	9 gms.
	Sodium sulphite	320 ,,	37 ,,
	Make up with distilled water to	20 ozs.	1000 c.c.s.
B.	Sodium carbonate	400 grs.	460 gms.
	Ammonium carbonate... ...	400 ,,	460 ,,
	Ammonium bromide	40 ,,	46 ,,
	Make up with distilled water to	2 ozs.	1000 c.c.s.

Continue the development until all but the faintest details are visible, then immediately wash the print thoroughly in running water to remove entirely the developer before placing it in the toning bath. All after-treatment will be the same as given above for printed-out prints.

MARION'S "QUICK PRINT" PAPER.

Expose to diffused daylight for from one to ten seconds, or to, say, 1 inch of magnesium burnt 12 inches from the negative.

Amidol Developer.

Soda sulphite (pure cryst.) ...	200 grs.	46 gms.
Amidol	20 ,,	4.6 ,,
Potass bromide (10 % solution)	10 drops	35 drops
Water	10 ozs.	1000 c.c.s.

Adurol Developer.

Adurol	20 grs.	4.6 gms.
Soda carbonate	200 ,,	46 ,,
Soda sulphite	200 ,,	46 ,,
Potass bromide	5 ,,	1 gm.
Water to...	10 ozs.	1000 c.c.s.

Time of exposure with average negative, one inch magnesium ribbon burnt at one foot distant. Time of development, one minute.

Developer for Warm Tones.

Adurol	20 grs.	2.3 gms.
Soda carbonate	200 ,,	23 ,,
Sodium sulphite	200 ,,	23 ,,
Potass bromide	25 ,,	3 ,,
Water to...	20 ozs.	1000 c.c.s.

Time of exposure with average negative, six inches magnesium ribbon burnt to one foot distant. Time of development, four minutes.

Should the prints show a lack of purity in the whites, add to the developer a few drops more of 10 per cent. bromide solution.

Marion's Bromide Paper.

Amidol Developer.

(One-solution.)

Amidol	40 grs.	4.6 gms.
Sodium sulphite	400 ,,	46 ,,
Potass bromide	5 ,,	.8 gm.
Water to make up to	20 ozs.	1000 c c.s.

Metol Developer.

(One-solution.)

Metol	40 grs.	4.6 gms.
Sodium sulphite	320 ,,	37 ,,
Potass carbonate	320 ,,	37 ,,
Potass bromide	5 ,,	.8 gm.
Water to make up to	20 ozs.	1000 c.c.s

The metol should be dissolved in the water before the addition of the other chemicals.

Marion's Collodio-Chloride Paper.

For Warm Black Tones—Platinum Toning Bath.

Potassium chloroplatinite ...	15 grs.	1 gm.
Phosphoric acid (s.g. 1.120) ...	2½ drachms	9 c.c.s.
Water	35 ozs.	1000 ,,

Remove prints as soon as they are of desired tone, which will be in from two to six minutes, according to age of bath. Wash well before fixing.

Blue-Black Tones—Gold Toning Bath.

Chloride of gold	2 grs.	.13 gm.
Borax	80 ,,	5 gms.
Water	25 ozs.	700 c.c.s.

Make up two hours before use.

Keep prints in this bath until they assume a purple tone, then wash in several changes of water and transfer to platinum bath (given above). Remove when they reach a rich black. If prints do not remain long enough in platinum bath they will be blue-black with impure half tones.

Wash after toning for half an hour in five or six changes of water then fix.

Fixing Bath.

Hypo	1 oz.
Water...	20 ozs.

Fix for 10 to 15 minutes.

Sepia Tones

Wash prints in five or six changes of luke-warm water, to the last three of which add 1 per cent. of liquid ammonia .880 (not stronger or blisters will be produced). When lemon-yellow wash in five or six changes of water and tone in the platinum bath. Wash and fix as usual.

Red Carbon Tones.

Wash prints in three changes of water, then place in a bath of—

Common salt	1 tea-spoonful
Water	40 ozs.

As soon as they become yellow remove, rinse in water, and place in the borax gold bath. Just as they are reaching tone desired again place them in salt bath to stop further toning, and, after rinsing in water, fix as usual,

Brown and Dark Blue Tones.

Print dark, and treat as for red carbon tones, but tone in platinum bath only.

Purple Tones.

Print very dark. Wash in three changes of water and place in the following bath:—

Gold chloride (1 °/₀ solution) ...	1 oz.	10 c.c.s.
Acid hydrochloric pure ...	3 ozs.	30 ,,
Water	10 ,,	100 ,,

Less acid gives a blue tone. More acid gives a purple tone. Tone until desired colour is obtained. Wash and fix as usual.

MAWSON & SWAN'S FORMULÆ.

THE "MAWSON," "FELIXI," "CELERITAS," "ELECTRIC," AND "CASTLE" PLATES.

DEVELOPERS.

Pyro-Ammonia Developer.

Stock Solution (10 per cent.)

Pyrogallic acid	480 grs.	110 gms.
Bromide of ammonium ...	240 ,,	55 ,,
Metabisulphite of potassium...	480 ,,	110 ,,
Distilled water to make up (fl.)	10 ozs.	1000 c.c.s.

Dissolve the metabisulphite in part of the water, then add the other ingredients, and make up to bulk with water.

A. Stock solution	300 minims	62 c.c.s.
Distilled water to make up to (fl.)	10 ozs.	1000 ,,
B. Liquid ammonia (.880) ...	70 minims	14.5 ,,
Distilled water to make up to (fl.)	10 ozs.	1000 ,,

Use equal parts of A and B mixed at time of developing.

2.—Pyro-Soda Developer.

Stock Solution.

Pyrogallic acid	480 grs.	110 gms.
Metabisulphite of potassium...	120 ,,	28 ,,
Distilled water to make ...	10 ozs.	1000 c.c.s.

Dissolve the metabisulphite before adding the other ingredients.

A. Stock solution	600 minims	125 c.c.s.
Distilled water to make ..	10 ozs.	1000 ,,
B. Carbonate of soda (cryst.) ...	480 grs.	110 gms.
Sulphite of soda	640 ,,	146 ,,
Distilled water to make ...	10 ozs.	1000 c.c.s.

Use equal parts of A and B.

DEVELOPERS FOR MAWSON "ORTHO A" AND "ORTHO B" PLATES.

Pyro-soda.

The above formula, with the addition of 40 grs. (9 gms.) potass bromide to the stock solution, gives excellent results.

To Correct Errors in Exposure.—If under-exposed, use a larger proportion of B; if over-exposed, decrease the proportion of B, and add a few drops of a 10 per cent. solution of bromide of potass.

RODINAL DEVELOPER.

Rodinal	1 part.
Water	25 parts.

AMIDOL DEVELOPER.

Amidol	100 grs.	23 gms.
Sulphite of soda	1000 ,,	228 ,,
Bromide of potass	10 ,,	2.3 ,,
Distilled water to make to ...	10 ozs. (fl.)	1000 c.c.s.

Use 1 part to 3 parts water.

THE MAWSON PHOTO-MECHANICAL PLATE. DEVELOPERS.

Pyro-Ammonia Developer.

A.	Pyrogallic acid	30 grs.	7 gms.
	Bromide of ammonium... ...	30 ,,	7 ,,
	Metabisulphite of potassium ...	30 ,,	7 ,,
	Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B.	Liq. ammoniæ (.880)	70 minims	14.5 ,,
	Distilled water to make up to (fl.)	10 ozs.	1000 ,,

Use equal parts of A and B mixed at time of developing.

Hydroquinone Developer.

A.	Hydroquinone	40 grs.	9 gms.
	Bromide of potassium	10 ,,	2 ,,
	Metabisulphite of potassium...	40 ,,	9 ,,
	Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B.	Caustic potass (sticks)... ...	80 grs.	18 gms.
	Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

THE MAWSON LANTERN PLATE.

Developers.

Exposure.—A negative of average density requires about 15 seconds at 1 foot from a No. 6 bat's-wing burner. Short exposure tends to produce black tones; long exposure, brown tones.

Either of the following developers may be used, though we give the preference to the pyro-ammonia, greater variety of tone being available by it.

Development begins rather slowly, especially with the hydroquinone formula, afterwards proceeding more rapidly.

Pyro-Ammonia Developer.

A.	Pyrogallic acid	20 grs.	4.5 gms.
	Bromide of ammonia	20 ,,	4.5 ,,
	Metabisulphite of potassium...	50 ,,	11.5 ,,
	Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

B. Liq. ammoniæ (.880)	70 minims	15 c.c.s.
Distilled water to make up to (fl.)	10 ozs.	1000 ,,

Use equal parts of A and B mixed at time of developing.

Hydroquinone Developer.

A. Hydroquinone	40 grs.	9 gms.
Bromide of potassium... ...	40 ,,	9 ,,
Metabisulphite of potassium...	40 ,,	9 ,,
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B. Caustic potass (sticks) ...	80 grs.	18 gms.
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.

Use equal parts of A and B mixed at time of developing.

Eikonogen Developer.

A. Eikonogen	100 grs.	23 gms.
Bromide of potassium	20 ,,	4.6 ,,
Sulphite of sodium (recrystd.)	100 ,,	23 ,,
Distilled water to make up to (fl.)	10 ozs.	1000 c.c.s.
B. Washing soda	600 grs.	137 gms.
Distilled water to make up to (fl.)	10 ozs.	10C0 c.c.s.

Use equal parts of A and B mixed at time of developing.

Amidol Stock Solution.

(For Black Tones.)

Amidol	10 grs.	23 gms.
Sodium sulphite	100 ,,	230 ,,
Potass bromide	¼ gr.	1 gm.
Distilled water, to make up ...	1 oz.	1000 c.c.s.

Stock solution, 1 part; water, 4 parts.

Amidol loses energy if kept long in solution, but the above would be right for, say, a week, and for some time beyond that the only practical difference would be slowing of development.

Clearing Solution.

Hydrochloric acid	¼ oz. (fl.)	50 c.c.s.
Saturated solution of alum, to	10 ,,	1000 ,,

Sulphocyanide Toning Solution.

(For Blue-Black and Blue Tones.)

A.

Chloride of gold	15 grs.	1 gm.
Distilled water, to make up ...	7½ ozs. (fl.)	212 c.c.s.

B.

Sulphocyanide of ammonium ...	40 grs.	3 gms.
Distilled water, to make up ...	4 ozs. (fl.)	113 c.c.s.

Use 1 part of A and 4 parts of B, mixed at time of using. This order of mixing must not be reversed.

THE OZOTYPE CO.

The following are the working instructions for the Ozotype process (gelatine). The instructions for Gum Ozotype were published in the 1905 ALMANAC.

The sensitive paper is printed in daylight until all details are visible, except light clouds.

Washing.—The print should be washed in cold running water until the margin covered by the rebate of the printing frame is quite clean and white, but care should be taken not to wash too long.

The extent of washing is dependent upon the temperature of the water, the times given below being generally sufficient :—

6 to 10 minutes in summer.
15 to 20 minutes in spring and autumn.
20 to 30 minutes in winter.

Where running water is not available, wash in 4 changes for 5 minutes longer than the above-mentioned times. The printing and washing should be done as soon as possible after the receipt of the sensitised paper. After the print is washed and dried the pigmenting operation can be deferred for some months.

Pigmenting.—The following solution, called the "acid bath," should be prepared :—

CONCENTRATED ACID OR REDUCING BATH.

20% solution sulphate of copper	5 ozs.	100 c.c.s.
Glacial acetic acid	$2\frac{1}{2}$ drachms	6 ,,
Glycerine	2 ,,	5 ,,
Hydroquinone	2 ,,	5 gms.

Warm the solution to dissolve the hydroquinone. This solution will turn green from production of acetate of copper, but it need not be rejected until it changes to a decided brown colour. It will keep a month or more in workable condition.

WORKING BATHS.

A. Concentrated acid bath, as above	2 drachms	6 c.c.s.
Water	40 ozs.	1000 ,,
B. Concentrated acid bath, as above	4 drachms	12 c.c.s.
Water	40 ozs.	1000 ,,
C. Concentrated acid bath, as above	6 drachms	18 c.c.s
Water	40 ozs.	1000 ,,

The diluted acid bath will keep good for about three days, and may be used for a number of prints in succession.

If the negative is thin—print lightly, use bath A, and develop about 60 minutes after squeegeeing.

For a medium negative use bath B, and develop about 45 minutes after squeegeeing.

For negatives with strong contrasts and deep shadows—print well, use bath C, and develop about 30 minutes after squeegeeing.

Bath A should not be used for prints with very deep shadows.

The best temperature for the acid bath is 60 degrees F. for smooth papers, and 75 degrees F. for rough papers.

Before placing the initial prints in the acid bath, it is advisable to note with a pencil the time on the back, and also the particular bath used

Pour the acid solution into a porcelain dish somewhat larger than the print to be pigmented. Take the pigment plaster and place it in the acid bath, face downwards.

As soon as the plaster becomes limp (which will take place as a rule in 30 to 60 seconds after immersion), turn it face upwards in the bath. Now take the print (which may be either wet or dry), and immerse it gently face downwards under the surface of the solution, and remove any airbells by dipping and redipping the print several times. Then, without losing any time, bring the print into contact with the pigment plaster under the surface of the solution. Withdraw the two papers, clinging together, from the bath, and press them into contact with a flat squeegee upon some smooth, hard surface, such as a *papier mache* board or a sheet of zinc or glass. Then hang the plastered print up till ready for development.

N.B.—The operation of bringing the print into contact with the plaster in the acid bath should not take much longer than about 15 seconds, otherwise the acid may weaken the print.

Development.—Immerse the plastered print in water at about 110 to 115 degrees F., and wait for about half a minute, then try at the corner if the plaster backing is likely to strip off easily. If such is the case, separate the plaster backing from the print with a steady, unbroken pull. This should be done under the surface of the water. The development is now carried out by either leaving the picture in the water to gradually develop itself, or by supporting it on a zinc plate and pouring warm water upon it from a mug. A soft camel-hair brush may be used for brightening high-lights and putting in clouds, or otherwise modifying the picture.

After development there is nothing left that would affect the keeping quality of the picture; but should the print require to be hardened for wet mounting, etc., a bath of 5 per cent. solution of alum may be employed.

THE PAGET PRIZE PLATE CO., LTD.

Developers for XXXXX "Swift" and XXX "Special Rapid" Plates.

PYRO-AMMONIA.

P.	Pyrogallic acid	1 oz.	50 gms.
	Citric acid	60 grs.	7 ,,
	Sodium sulphite (pure) ...	$2\frac{1}{2}$ ozs.	125 ,,
	Distilled water to make ...	20 ,,	1000 c.c.s.

A. Liq. ammoniæ .880	... ...	1 oz.	50 c.c.s.
Ammonium bromide	... ...	120 grs.	14 gms.
Distilled water to make	...	20 ozs.	1000 c.c.s.

Studio Developer.—Dilute 1 part of P with 5 parts of water, and dilute 1 part of A with 5 parts of water. Mix the two dilute solutions in equal quantities for use. (Such developer contains about 2 grs. pyro, 2 minims ammonia, $\frac{1}{2}$ gr. bromide, 5 grs. sulphite, $\frac{1}{4}$ gr. citric acid, in each ounce.) If a thinner and softer negative be desired, use less of P.

Pyro-Soda.

1. Pyrogallic acid ...	... ...	$\frac{1}{4}$ oz.	12.5 gms.
Sulphuric acid ...	... ...	5 drops	0.5 c.c.
Distilled water to make	...	20 ozs.	1000 c.c.s.
2. Carbonate of soda (cryst. pure)		2 ozs.	100 gms.
Sulphite of soda (pure)	...	2 ,,	100 ,,
Distilled water to make	...	20 ,,	1000 c.c.s.

For studio use, 1 part of each and 2 parts of water (making 4 parts altogether) will be found about right. Such developer contains about 3 grs. pyro and 22 grs. each of carbonate and sulphite to each oz.

Hydroquinone.

Stock Solutions.

No. 1. Hydroquinone ...	... ...	1 oz.	25 gms.
Sulphurous acid (B.P.)	...	$\frac{1}{2}$,,	12.5 ,,
Potass bromide...	... ...	$\frac{1}{4}$,,	6.2 ,,
Distilled water to make	...	40 ozs.	1000 c.c.s.
No. 2. Caustic soda (in sticks)	...	1 oz.	25 gms.
Sod. sulphite ...	... ...	5 ozs.	125 ,,
Distilled water to make	...	40 ,,	1000 c.c.s.

These solutions may be used in equal quantities without dilution, or may be diluted with an equal or greater quantity of water, in order to get softer results; but hydroquinone alone is hardly a suitable developer for general subjects, as it has too much tendency to give hard, dense negatives with insufficient detail. It gives great density with very clear shadows, and is therefore extremely useful in cases where a negative of stencil-plate character is required, such as for copying woodcuts, line engravings, pen and ink sketches, printed matter, etc.

"Paget" Lantern Plate Developer.

Solution No. 1.

Hydroquinone ...	... ...	$\frac{1}{2}$ oz.	25 gms.
Sulphurous acid	... ...	$\frac{1}{4}$,,	12.5 ,,
Potassium bromide	... ...	60 grs.	7 ,,
Water to... ...	... ...	20 ozs.	1000 c.c.s.

Solution No. 2.

Caustic soda ...	... ...	$\frac{1}{2}$ oz.	25 gms.
Sodium sulphite	... ...	$2\frac{1}{2}$ ozs.	125 ,,
Water to... ...	... ...	20 ,,	1000 c.c.s.

Solution No. 3 for Warm Tones.

Bromide of ammonium ...	1 oz.	50 gms.
Carbonate of ammonium ...	1 ,,	50 ,,
Water to...	20 ozs.	1000 c.c.s.

Carbonate of ammonium should be in clear lumps ; if from exposure to the air it has become coated with the white powdery bicarbonate, the latter should be scraped off.

The following table shows how the developer should be used for black and warm tones. The bromide of ammonium which is contained in No. 3 solution restrains the plate from developing too quickly, and the carbonate of ammonium, which also appears to act as a restrainer, assists in producing a much warmer deposit than can be secured by means of the use of the bromide alone. The longer the exposure which is given to the plate, the more of the No. 3 solution *must be used*, and the warmer the resulting slide will be. By following this simple method, a range of tones from black through warm black, brown, purple brown, and purple to red may be secured.

It should be noted that the proportion of the No. 3 solution used determines the *time of development* as well as the colour of the image. The table shows approximately the relative exposures, proportion of No. 3 solution, and time of development :—

Relative Time of Exposure.	Constitution of Developer.	Time of Development.	Colour of Deposit.
30 secs. ...	No. 1 ... ½ oz. No. 2 ... ½ ,, Water to make 2 ozs.	2½ to 3 minutes	Black
One minute...	No. 1 ... ½ oz. No. 2 ... ½ ,, No. 3 ...100 minims Water to make 2 ozs.	5 minutes ...	Brown
One and half minutes	No. 1 ... ½ oz. No. 2 ... ½ ,, No. 3 ...200 minims Water to make 2 ozs.	10 minutes...	Purple brown
Three minutes	No. 1 ... ½ oz. No. 2 ... ½ ,, No. 3 ...250 minims Water to make 2 ozs.	12 minutes...	Purple
Five minutes	No. 1 ... ½ oz. No. 2 ... ½ ,, No. 3 ...300 minims Water to make 2 ozs.	15 minutes...	Red

"Gravura" Paper and Lantern Plates.

Developer for Black Tones.

Metol	1 oz.	6 gms.
Sodium sulphite	8 ozs.	48 ,,
Sodium carbonate (cryst.) ...	10 ,,	60 ,,
Potass bromide	16 grs.	.25 gm.
Water to make	160 ozs. (1 gallon)	1000 c.c.s.

The addition of a few drops of cyanide solution, as advised under "Clearing Prints," is strongly recommended where *glossy* paper is used, or if the paper is at all old. In any case it does no harm to the print and helps to keep it clean.

The sulphite and carbonate of soda both vary much in quality; they must be good, and in clean, clear crystals. This developer, if kept in well-stoppered bottles, will remain in good condition for a long time, but cannot be kept *after use*, although the same developer may be used for several successive prints developed immediately after each other.

The above formula gives good gradation and an excellent black tone, but it *cannot* be used for colours.

Developer for Colours.

Stock Solution H.

Hydroquinone	1 oz.	55 grs.	6 gms.
Metol	¼ ,,	14 ,,	1.5 gm.
Sodium sulphite (re-cryst.)	8 ozs.	1 oz.	48 gms.
Sodium carbonate (cryst.)	10 ,,	1¼ ,,	60 ,,
Potass bromide	16 grs.	2 grs.	.25 gm.
Water to make	160 ozs. (1 gallon)	20 ozs.	1000 c.c.s.

Stock Solution A.C

Ammonium bromide	1 oz.	50 gms.
Ammonium carbonate... ...	1 ,,	50 ,,
Water to make	20 ozs.	1000 c.c.s.

Development for Colours.

Cool to Warm Sepias. Exposure—5 to 6 times Black.

Developer.

Stock solution H.	1 oz.	30 c.c.s.
Stock solution A.C. ...	50—60 minims	3—3.5 ,,
Water to make...	6 ozs.	170 ,,

Warm Brown to Red. Exposure—6 to 8 times Black.

Developer.

Stock solution H.	... ...	1 oz.	30 c.c.s.
Stock solution A.C.	... ...	$\frac{1}{4}$,,	7 ,,
Water to make...	... ...	8 ozs.	230 ,,

Red Chalk. Exposure—8 to 10 times Black.

Developer.

Stock solution H.	... ...	1 oz.	30 c.c.s.
Stock solution A.C.	... ...	$\frac{1}{2}$,,	15 ,,
Water to make...	... ...	20 ozs.	570 ,,

Red development may take 5 minutes or more.

Clearing Solution.

To remove friction marks and improve colour and clearness of prints.

Stock Solution 1.

Hypo	... ...	1 oz.	50 gms.
Water	... ...	20 ozs.	1000 c.c s.

Stock Solution 2.

Potass ferricyanide (Red prussiate of potash) ...	...	30 grs.	14 gms.
Water	...	5 ozs.	1000 c.c.s.

For use, add $\frac{1}{2}$ drachm of No. 2 to each oz. of No. 1, and lay the print in the mixture, in a clean dish. The marks can then be easily removed by gentle rubbing with a pad of cotton wool. Wash and dry the print as usual.

Surface marks may be to a great extent prevented by adding to each oz. of developer 3 or 4 drops of a 10 per cent. solution of cyanide of potassium. This solution is extremely poisonous.

Paget Prize Gelatino-Chloride Printing-Out Paper.

Ordinary or Matt Surface.

Printing should be somewhat darker than the finished print is required.

It should be borne in mind, when toning, that the finished image will be bluer and slightly stronger when dry than in the wet state.

Toning.—The following bath is strongly recommended in preference to any other :—

Sulphocyanide of ammonia	...	12 grs.	3.5 ,,
Gold chloride	...	1 gr.	.3 gms.
Water	...	8 ozs.	1000 c.c.s.

Before immersion in this toning bath, the prints should be *very thoroughly washed* for at least 15 minutes in running water. This is necessary to ensure even toning.

If it is desired to tone more slowly, a small quantity of sulphite of sodium, say, from a ¼ to ½ a gr. for each grain of gold used, should be added to the toning bath. This makes the toning much *slower* and *more even*. In professional work, where a large number of prints are toned at once, the addition of sulphite is very useful, as the slower toning gives more time for examination.

If decidedly *warm* tones (really pure light browns and red browns) are desired, they cannot be satisfactorily obtained in the usual bath. In such cases the following formula is recommended :—

Gold chloride	1 gr.	.15 gm.
Ammonium sulphocyanide ...	8 grs.	11.5 gms.
Sodium sulphite, pure... ...	1 gr.	.15 gm.
Water to make	16 ozs.	1000 c.c.s.

Tone to the desired colour, judging by looking through. Toning is slow, taking from 5 to 10 or 12 minutes. When toned, rinse the prints in water and place in—

Ammonium sulphocyanide ...	½ oz.	25 gms.
Water	1 pint	1000 c.c.s.

for about 2 minutes ; then fix and finish as usual.

Developing.

The Paget Partial Development process is given under Standard Formulæ for the Principal Photographic Processes.

Paget Prize Collodio-Chloride Printing-Out Paper.

Toning Bath.

Any of the ordinary toning baths employed for albumen or gelatine may be used, but no bath gives such rich, brilliant tones, either warm or cold, as the sulphocyanide. If a little care be taken to ensure clean dishes and clean fingers, there is no bath more simple or certain. We strongly recommend this bath in preference to any other.

Sulphocyanide of ammonia ...	30 grs.	4 gms.
Gold chloride	2 ,,	0.3 ,,
Water	16 ozs.	1000 c.c.s.

Tone to exactly the colour desired, judging the prints as they lie in the dish ; but it should be borne in mind that the finished image will be slightly bluer and stronger when dry than in the wet state. Wash and fix in—

Hyposulphite of soda	3 ozs.	150 gms.
Water	1 pint	1000 c.c.s.

If this bath be found to tone too quickly, sulphite of soda may be added at the rate of ¼ to ½ gr. for every grain of gold used (say 1 gr. for above quantity). This will make the bath work more slowly, without making any other difference. More or less may be used, so as to regulate the speed desired. The sulphite should be kept in a stock solution, and added to the bath immediately before use.

Paget Self-Toning Paper.

Instructions.

Print a little deeper than finished print is required (about the same as for P.O.P.). To obtain a warm brown tone, wash print in running water, or several changes, for 5 minutes, then place in fixing bath—

Hypo	3 ozs.	150 gms.
Water	20 ,,	1000 c.c.s.

for 10 minutes; wash thoroughly and dry. If a colder tone be desired, *instead* of first washing, place print in a solution of—

Common salt	2 ozs.	100 gms.
Water	20 ,,	1000 c.c.s.

for 5 minutes, then rinse in water and fix as above.

It is most important that the hypo bath consist of nothing but good quality hypo and water only. If there be any suspicion of the hypo being acid, a few drops of ammonia or a small quantity of bicarbonate of soda (say half a small tea-spoonful to a pint of bath) may be added in order to make the bath slightly alkaline; in any case this will do no harm, but no other additions of any kind are allowable. The hypo solution must not have been used before for any purpose whatever.

The colour of the print cannot be judged while wet; its final tone is not arrived at until quite dry. Prints may be quickly dried in front of the fire as they do not soften like gelatine.

Prints on glossy paper may be burnished or otherwise treated in the same way as ordinary collodion paper.

Black Tones on Paget Self-Toning Paper.

A fine olive black tone can be obtained in the following way :—

Platinum Stock Solution.

Potassium chloroplatinite ...	15 grs.	1 gm.
Sodium chloride	150 ,,	10 gms.
Citric acid	150 ,,	10 ,,
Water to make	$7\frac{1}{2}$ ozs.	220 c.c.s.

For use, take 1 part of stock solution, and 10 parts water.

The prints must first be put into a bath of common salt 1 oz., water 10 ozs., for 5 minutes, washed, and then placed in the platinum bath, and kept constantly moving, until all trace of red has disappeared from the print when it is looked through. This will take from 5 to 10 minutes. Wash again for 5 minutes in running water, or several changes. Fix in the ordinary hypo fixing bath.

The platinum bath may be kept and used over and over again. When showing signs of exhaustion by toning too slowly, it may be strengthened by the addition of a small quantity of the stock solution.

Should a more olive tone be desired, omit the salt bath, but wash the prints very thoroughly before putting them in the platinum solution.

Glazing Collodion Prints.

If a highly glazed surface is desired take a piece of plate glass which has been made thoroughly clean, but need *not* be French chalked or prepared in any way. Lay the glass flat in a sink or on a level bench and wet its upper surface with clean water. Take the wet print out of the washing water, and lay it, face downwards, on the wet glass. Roll the back of the print several times backwards and forwards with a *roller* squeegee, rolling hard with firm pressure. Pressure is essential, otherwise you will not get a good gloss. Wipe or blot off any surplus water from the glass, and now dry the print on the glass before the fire, or in any way you like, so long as the paper is not scorched, or the glass cracked. When thoroughly dry, wet the back of the print again, or you may put glass and all under water if preferred. In about 3 minutes you can lift one corner of the print, and with a steady pull peel it off the glass. It has now a splendidly glazed surface, which is not injured by any subsequent wetting, and therefore presents none of the usual difficulties in handling and mounting. As it is not injured by any moderate heat, the print may also be dried again in a few minutes.

PHOTOLINOL, LTD.

Developer for Photolinol Fabric.

Amidol	20 grs.	6.5 gms.
Sodium sulphite	180 ,,	58 ,,
Water	7 ozs.	1000 c.c.s.

Dissolve the amidol in half the water, the sulphite in the remaining water, and then put the *sulphite into the amidol*. The developer has to be thoroughly cooled down before using.

Sepia Toning Bath.

Bleaching Bath.

Potassium ferricyanide ...	1 oz.	100 gms.
Water	10 ozs.	1000 c.c.s.

Immerse until the image disappears. Then wash for 2 minutes and immerse in :—

Sodium sulphide	1 oz.	20 gms.
Water	50 ozs.	1000 c.c.s.

Then wash about 30 minutes.

"RAJAR" LIMITED.

Developer for "Cleron" Roll and Flat Films.

Pyro-Soda.

No. 1. Metabisulphite of potash ...	30 grs.	3.5 gms.
Water	20 ozs.	1000 c.c.s.

Dissolve and add—

Pyrogallic acid	$\frac{1}{4}$ oz.	12.5 gms.

No. 2. Carbonate of soda crystals	...	2 ozs.	100 g.m.s.
Sulphite of soda crystals	...	2 ,,	100 ,,
Bromide of potassium ...	...	10 grs.	1 gm.
Water	...	20 ozs.	1000 c.c.s

For correct exposure, use one part of No. 1, and one part of No. 2.

For under exposure, use one part of No. 1, two parts of No. 2, and one part of water.

For over exposure, use two parts of No. 1, one part of No. 2, and 10 to 20 drops of a 10 per cent. solution of bromide of potassium per ounce of mixed developer.

"Rajar" Bromide Paper.

Metol-Hydroquinone.

Metol	...	8 grs.	.9 gm.
Hydroquinone	...	30 ,,	3.45 gms.
Sodium sulphite (cryst.)	...	¾ oz.	37.5 ,,
Sodium carbonate (cryst.)	...	¾ ,,	37.5 ,,
Potassium bromide ...	...	2 grs.	.2 gm.
Water	...	20 ozs.	1000 c.c.s.

"Rajar" P.O.P.

After removal from the printing frames, and when a sufficient number of prints have been made, they should be washed for from 10 to 15 minutes in running water, or in several changes of water, and they are then ready for toning. In engineering works, or where there is any iron in the water used, it is better to place the dry prints in a solution of salt (common salt 1 oz., water 40 ozs.) before washing. This bath completely prevents the iron from producing black specks in the prints.

Toning Bath.

Dissolve and add—

Water	...	20 ozs.	1000 c.c.s.
Sulphocyanide of ammonia	...	20 grs.	2.3 gms.
Gold chloride	...	2 grs.	.23 gm.

This bath produces dark brown to purple black tones, but if warm tones are desired it is advisable to dilute the bath with the following solution—

Sulphite of soda ...	...	2 grs.	.23 gm.
Water	...	20 ozs.	1000 c.c.s.

This volume of toning bath (*i.e.*, 2 grs. of gold) will tone 1¼ sheet of paper 24½ by 17 ins., or a 1s. packet, to a purple tone. If warm tones only are desired the same bath will tone about 2 sheets of paper 24½ by 17 ins. The tone should be judged by looking through the print. After toning wash for a few minutes in water.

Fixing.—Use a fresh bath for each batch of prints.

FIXING SOLUTION.

Hypo	3 ozs.	150 gms.
Water	20 ,,	1000 c.c.s.

Keep the prints moving about in the solution for 10 to 15 minutes.

FINAL WASHING.—Wash for 1 or 2 hours in running water or in many changes.

MOUNTING.—The prints may be mounted with starch paste in the usual way. For burnishing, a roller burnisher is far superior to a bar burnisher.

ENAMELLING.—The prints after the final washing may be enamelled by squeegeing down upon ferrotype plates or waxed glass plates. If the prints are to be afterwards mounted, a piece of thick writing paper should be pasted on the back as soon as it is squeegeed upon the plate to prevent the gloss being spoiled by the mounting solution, or the prints should be soaked, previous to enamelling, in a solution composed of—

Commercial formalin (40 %) ... 1 oz.; water, 20 ozs.

ROTARY PHOTOGRAPHIC CO., LTD.

"ROTOGRAPH" NEGATIVE PAPER.

A.	Ortol	1 oz.	16.5 gms.
	Potass metabisulphite... ...	½ ,,	8.2 ,,
	Water	60 ozs.	1000 c.c.s.
B.	Soda carbonate (cryst.) ...	12 ,,	200 gms.
	Soda sulphite (cryst.)	8 ,,	130 ,,
	Water	60 ,,	1000 c.c.s.

For use take A, 1 part; B, 1 part; water, 10 parts.

Fixing.—A 10 per cent. solution of hyposulphite can be used; but an acid bath made as follows is better :—

Sodium sulphite (cryst.) ...	1 oz.	50 gms.
Water	20 ozs.	1000 c.c.s.
Citric acid	100 grs.	11.5 gms.
Hypo	4 ozs.	200 ,,

Mix the chemicals in the order given, adding the hypo after the sulphite and citric acid have completely dissolved.

Washing.—Wash for 1 hour in frequent changes. Be careful in washing and rinsing the paper that the stream of water does not run directly on the film. This is liable to lead to blisters of the film.

Hardening.—In order to harden the film of the negative paper, place for a few minutes in 10 per cent. alum solution, and wash afterwards for a quarter of an hour.

Drying.—The negatives are hung up or laid on blotting-paper.

The Paper is sufficiently transparent to print quickly without further treatment. If, however, great transparency is required, the following mixture should be rubbed into the back of the paper with cotton wool :—

Canada balsam	1 oz.
Turpentine	5 ozs.

Another method is to coat the back of the paper with a solution of castor oil, 1 oz., in absolute alcohol, 2 ozs.

"Rotary" Carbon Tissue and Stripping Films.

Sensitising Bath.

Sensitise by immersion for 1 minute in the following bath :—

Potass bichromate	1 oz.	30 gms.
Water	30 ozs.	900 c.c.s.
Ammonia (.880)...	1 drachm	3 5 ,,

About 1 drachm of ammonia (.880) are added to every 30 ozs. of the bath ; or a better way is to add the ammonia until the bath turns red litmus paper blue. The bath must be neutralised in this way, as, if left acid, the keeping properties of the sensitised tissue are greatly affected. The bath can be used several times, being stored in the dark. If it takes a brownish tint it must be discarded for a fresh one.

Stronger bichromate baths give a more sensitive tissue than weak ones. A tissue sensitised in a 4 per cent. bath is 4 times as sensitive as one treated in a bath of 1 per cent. The strength of the bath likewise affects the character of the print, negatives of great contrasts requiring stronger baths and those tending to flatness, weaker baths. The temperature of the bath should not rise above 62 per cent. F., otherwise the film of pigment and gelatine is softened and may even dissolve in certain circumstances.

Gelatine and chrome alum solution for use in assembling positives on the three-colour stripping films—

Ordinary gelatine	150 grs.	10 gms.
Warm water	30 ozs.	900 c.c.s.

After complete solution, add—

Chrome alum (10 °/₀ solution)...	¾ oz.	20 c.c.s.

Stirring well and filtering.

"Roto" P.O.P.

Toning Formula.

Stock Gold Solution.

	Gold chloride	15 grs.	1 gm.
	Water (boiled or distilled) to...	15 drachms	60 c.c.s.
No. 1.	Sulphocyanide of ammonium...	60 grs.	7 gms.
	Water (boiled or distilled) to...	20 ozs.	1000 c.c.s.
No. 2.	Stock gold solution	5 drachms	30 ,,
	Water to...	20 ozs.	1000 ,,

For use, take equal quantities of No. 1 and No. 2. (16 ozs. of the mixed solution will tone 16 half-plate prints.)

In making up this bath add No. 2 slowly to No. 1, stirring all the time.

The bath is ready for use as soon as colourless, which takes an

hour or so; or hot water may be used for diluting the gold solution, in which case the bath is ready for use as soon as cold. Do not use the bath twice; as soon as it no longer tones, throw away and make fresh. The progress of toning (which should take 5 to 10 minutes) must be judged by holding prints up to the light and looking through them. Tone until the red ochre colour has passed into an even red-brown. The print when dry will always be bluer and "pluckier" than when wet.

"Rotograph" Bromide Papers.

Metol Developer.

Metol	50 grs.	5.8 gms.
Hydroquinone	40 ,,	4.6 ,,
Soda sulphite	500 ,,	58 ,,
Potass bromide	25 ,,	2.9 ,,
Sodium carbonate	.500 ,,	58 ,,
Water (distilled or boiled) to...	20 ozs.	1000 c.c.s.

This is a thoroughly reliable developer, yields brilliant prints, does not stain the fingers, and can be used repeatedly.

Amidol Developer.

Sodium sulphite	200 grs.	23 gms.
Water to...	6 ozs.	1000 c.c.s.
Potass bromide	1 gr.	.1 gm.
Amidol	20 grs	.7 ,,

Dilute 1 part of the above with 4 parts of water, and apply to the paper; as soon as the shadows have developed, pour off, and apply the strong solution till sufficient density is obtained; then pour off, wash well, and fix. This method gives rich blacks with brilliant whites.

Fixing Bath.

Soda sulphite	½ oz.	25 gms.
Hypo	2 ozs.	100 ,,
Water	20 ,,	1000 c.c.s.
Sulphuric acid	20 minims	2 ,,

Sulphide Toning.

The prints must first be bleached through the agency of potassium ferricyanide, for which purpose either of the following formulæ may be used:—

Potassium ferricyanide ...	10 grs.	2.3 gms.
Potassium or sodium chloride (common salt)	20 ,,	4.6 ,,
Water	10 ozs.	1000 c.c.s.

or—

Potassium ferricyanide ...	10 grs.	2.3 gms.
Potassium bromide or iodide...	10 ,,	2.3 ,,
Water	10 ozs.	1000 c.c.s.

After bleaching for a few seconds with either of these reagents it is only necessary to wash in running water from 3 to 5 minutes (according to the thickness of the paper), and then apply the following:—

Sodium sulphide	1 oz.	10 gms.
Water	100 ozs.	1000 c.c.s.

Two minutes immersion will complete the toning action.

"Rotox" Gaslight Paper.

Rodinal Developer.

Rodinal	1 oz.	50 c.c.s.
Water	20 ozs.	1000 ,,
Potass bromide (10 % solution)	25 minims	3 ,,

Metol–Hydroquinone.

Water	20 ozs.	1000 c.c.s.
Soda carbonate (cryst.) ...	2½ ,,	125 gms.
Soda sulphite (cryst.)	1 oz.	50 ,,
Metol	16 grs.	1.8 ,,
Hydroquinone	55 ,,	6.3 ,,
Potass bromide	3 ,,	.35 ,,

Pour the developer quickly and evenly over the whole print; or immerse the print film side down in the developer, turn it face up, and remove any air-bubbles with a tuft of cotton-wool.

Development takes place very quickly. If correctly exposed, the print attains full density in 5 to 10 seconds.

Avoid long development. Pure whites, proper colour in the shadows, and all the details in the picture can never be got if development has to be forced.

To stop development at once, place in the acetic acid bath as used for ferrous oxalate. Prints developed with alkaline developers, should remain here about half a minute, should be rinsed for 1 or 2 minutes in water, and transferred to the fixing bath. Formula for this is same as given above for "Negative Paper."

Make it a rule never to let prints lie one on the top of another in the fixing bath, but as soon as placed therein, keep them constantly on the move. This prevents spots and stains. After fixing, transfer to the alum or hardening bath, in which let the prints remain for 10 minutes.

ROUCH'S FORMULÆ.

A.	Pyrogallic acid	1 oz.	100 gms.
	Sulphite of soda	4 ozs.	400 ,,
	Water to make	10 ,,	1000 c.c.s.

Dissolve the sulphite of soda in hot water, and, when cold, add the pyrogallic acid. Should any portion of the sulphite refuse to dissolve the crystals may be allowed to remain in the bottle.

B.	Bromide of ammonium ...	1 oz.	100 gms.
	Water to make	10 ozs.	1000 c.c.s.

C.	Strongest liquor ammoniæ ...	3 ozs.	300 c.c.s.
	Water to make	10 ,,	1000 ,,

In case sulphite of soda be not readily obtainable, the following may be substituted for solution A as above, and used in the same manner :—

Pyrogallic acid	1 oz.	100 gms.
Citric acid	50 grs.	11 ,,
Water to make	10 ozs.	1000 c.c.s.

Dissolve the citric acid first, and then add the pyro.

THOMAS'S FORMULÆ.

Lantern or Transparency Plates.

Developing Formulæ.

For Black and Warm Tones.

No. 1.	Hydroquinone	160 grs.	10 gms.
	Sodium sulphite	2 ozs.	60 ,,
	Citric acid	60 grs.	4 ,,
	Potassium bromide	40 ,,	$2\frac{1}{2}$,,
	Water to...	20 ozs.	600 c.c.s.
No. 2.	Sodium hydrate	160 grs.	10 gms.
	Water to...	20 ozs.	600 c.c.s.
No. 3.	Bromide ammonium	2 ozs.	60 gms.
	Water to...	20 ,,	600 c.c.s.
No. 4.	Carbonate ammonium... ...	2 ozs.	60 gms.
	Water to...	20 ,,	600 c.c.s.

For Black Tones.

No. 1 ...	$\frac{1}{2}$ oz.	15 c.c.s.
No. 2 ...	$\frac{1}{2}$,,	15 ,,
Water to ...	2 ozs.	60 ,,

For Brown Tones.

No. 1 ...	$\frac{1}{2}$ oz.	15 c.c.s.
No. 2 ...	$\frac{1}{2}$,,	15 ,,
No. 3 ...	15 minims	1 c.c.
No. 4 ...	15 ,,	1 ,,
Water to ...	2 ozs.	60 c.c.s.

For Purple Tones.

No. 1 ...	$\frac{1}{2}$ oz.	15 c.c.s.
No. 2 ...	$\frac{1}{2}$,,	15 ,,
No. 3 ...	30 minims	2 ,,
No. 4 ...	30 ,,	2 ,,
Water to ...	2 ozs.	60 ,,

For Red Tones.

No. 1 ...	$\frac{1}{2}$ oz.	15 c.c.s.
No. 2 ...	$\frac{1}{2}$,,	15 ,,
No. 3 ...	90 minims	6 ,,
No. 4 ...	90 ,,	6 ,,
Water to ...	2 ozs.	60 ,,

The relative times of exposure and development for these tones are :—

	Black.	Brown.	Purple.	Red.
Exposure ...	30 secs. at 24 in.	30 secs. at 6 in.	30 secs. at 5 in.	60 secs. at 5 in.
Development ...	4 minutes	10 minutes	18 minutes	30 minutes

Cold Tones.

No. 1.	Pyrogallic acid	1 oz.	30 gms.
	Metabisulphite of soda ...	1 ,,	30 ,,
	Water to	100 ozs.	3000 c.c.s.

No. 2.	Washing soda	6 ozs.	180 gms.
	Potassium bromide	20 grs.	1.5 gm.
	Water to	100 ozs.	3000 c.c.s.

Take equal parts of each solution, and development should be completed in 5 to 7 minutes. Slightly over-develop to allow for loss in fixing.

Purple Tones.

No. 1.	Pyrogallic acid	1 oz.	30 gms.
	Metabisulphite of soda ...	1 ,,	30 ,,
	Water to	80 ozs.	2400 c.c.s.
No. 2.	Ammonium bromide	8 ozs.	240 gms.
	Liq. ammoniæ (.880)	4 ,,	120 c.c.s.
	Water to	80 ,,	2400 ,,

Use equal parts of each solution.

This developer allows great latitude in exposure, and takes from 3 to 12 minutes to develop, according to the amount of exposure given.

When using this developer, the image will appear buried and lacking in density if examined by ruby light, but, when fixed, will be fully dense, and the deposit will appear opaque by reflected light, and purple by transmitted light, improving in colour when dry.

Fixing Bath.

Hyposulphite of soda	4 ozs.	110 gms.
10 °/o solution of metabisulphite of soda	1 oz.	28 c.c.s.
Water to	20 ozs.	560 ,,

WELLINGTON AND WARD.

"WELLINGTON" SPEEDY, ISO SPEEDY, AND LANDSCAPE PLATES.

Pyro and Ammonia Developer.

No. 1.	Pyrogallic acid...	1 oz.	100 gms.
	Sulphite of soda	2 ozs.	200 ,,
	Citric acid	40 grs.	9.2 ,,
	Water to...	10 ozs.	1000 c.c.s.
No. 2.	Ammonia (.880)	1 oz.	100 c.c.s.
	Water to...	10 ozs.	1000 ,,
No. 3.	Ammonium bromide	1 oz.	100 gms.
	Water to...	10 ozs.	1000 c.c.s.

Take 10 minims (2 c.c.s.) of No. 1, 10 minims of No. 2 and 5 minims (1 c.c.) of No. 3 to each ounce (100 c.c.s.) of water.

Pyro and Soda Developer.

No. 1.	Pyrogallic acid	1 oz.	100 gms.
	Sulphite of soda	2 ozs.	200 ,,
	Citric acid	40 grs.	9.2 ,,
	Water to...	10 ozs.	1000 c.c.s.

No. 2. Carbonate of soda	8 ozs.	100 gms.
Sulphite of soda	8 ,,	100 ,,
Water to...	80 ,,	1000 c.c.s.

Normal Work.—Take 1 oz. of No. 2 and 1 dr. of No. 1, with water 1 oz.

Studio Work.—Take 1 oz. of No. 2 and ½ dr. of No. 1, with water 1 oz.

Fix in clean hypo 4 ozs. to the pint of water, after which wash as usual.

Wellington Celluloid Films.

The above pyro soda developer is used for the films, using—No. 1 1 drachm ; No. 2, 1 oz. ; water, 1 oz.

For over-exposed negatives, add 10 to 20 drops of the following, in 4 ozs. of developer, according to amount of over-exposure :—

Bromide potass	1 oz.
Water...	10 ozs.

This restrainer is to be used only in case of over-exposure.

The "Wellington" Lantern Plate.

Hydroquinone—For Cold Tones.

Hydroquinone	80 grs.	9.2 gms.
Sulphite of soda	1 oz.	100 ,,
Potass hydrate	80 grs.	9.2 ,,
Ammonium bromide	10 ,,	1 gm.
Water	20 ozs.	1000 c.c.s.

Pyro and Ammonia—For Warm Black Tones.

(Recommended as the best.)

Three stock solutions are prepared as given above for "Speedy" plates. These are used as follows :—Take 30 minims of No. 1, 60 minims of No. 2, and 30 minims of No. 3, with water, 1 oz.

For warm black tones. Time of development, 2 minutes.

For warmer tones, increase the exposure 4 to 6 times, also increasing No. 3 up to 90 minims. Time of development, 5 to 6 minutes.

Fix in clean hypo, 4 ozs. to the pint of water, after which wash as usual.

The "Wellington" Etching Plate.

Pyro-Soda Developer.

No. 1. Pyrogallic acid	1 oz.	100 gms.
Sulphite of soda	2 ozs.	200 ,,
Citric acid	40 grs.	9.2 ,,
Water to...	10 ozs.	1000 c.c.s.
No. 2. Carbonate of soda	8 ozs.	100 gms.
Sulphite of soda	8 ,,	100 ,,
Potass bromide...	40 grs.	1 gm.
Water to...	80 ozs.	1000 c.c.s.

Take 1 oz. of No. 2 and 1 dr. of No. 1.

Fix in clean hypo, 4 ozs. to the pint of water, after which wash as usual.

WELLINGTON-PLATINO MATT BROMIDE PAPER.

Having made the exposure, immerse the paper face upward in water until thoroughly soaked, then drain off and immediately flow the developer evenly over the surface. Insufficient soaking is the cause of air bubbles, producing white spots. (For small prints it is preferable to flow the developer over the dry exposed paper.)

We advocate amidol as being the most reliable developer for general purposes, although any other may be used.

Amidol Developer.

Amidol	50	grs.
Sulphite soda	650	,,
Potass bromide	10	,,
Water...	20	ozs.

This developer should be used within three days of mixing.

It is often recommended to keep a stock solution of sodium sulphite by itself, and to take some of this when wanted and add the amidol to it. *Our experience is that this will not do*, as amidol when used with stale sulphite solution develops very slowly, and there is a great loss of brilliancy in the resulting prints—a result for which the poor manufacturer gets the blame. The developer given above should therefore be mixed up as directed, and used within three days of mixing.

Metol Developer.

Metol ...	50	grs.
Hydroquinone	15	,,
Sulphite of soda	500	,,
Potass bromide	10	,,
Potass carbonate	100	,,
Water...	20	ozs.

Dissolve the metol in the water first. This developer keeps well.

The same solution may be used for two or more prints in succession.

The fixing bath we recommend is an acid-hypo bath, prepared as follows :—

Stock Solution.

Sulphite of soda	1	lb.
Sulphuric or acetic acid ...	2	ozs.
Water to make	80	,,

Acid Fixing Bath.

Hyposulphite of soda	4	ozs.
Stock acid sulphite solution as above...	1	,,
Water ...	20	,,

In such a bath a bromide print is completely fixed in five minutes, and on no account should be taken out before that time has elapsed. To ensure proper fixing, the bath should be fresh—that is, it should not have been employed for a batch of prints before, and they simply must not be piled on the top of others in it, but kept quite separate.

Toning Bromide Prints.

Stock Solution.

Ferricyanide of potassium ...	400 grs.	90 gms.
Bromide of potassium... ...	600 „	140 „
Water	10 ozs.	1000 c.c.s.

Take 1 oz. to each 10 ozs. of water.

Take the dried print and immerse in above until the image becomes bleached—this usually takes place under 5 minutes. After this, a mere rinse in water, and it is placed in the following sulphurising bath :—

Stock Solution.

Sulphide of soda	1 oz.	100 gms.
Water	10 ozs.	1000 c.c.s.

Take ½ oz. to 10 ozs. of water.

The image is converted into sulphide of silver very quickly, conversion being complete under a minute. Wash 15 minutes in running water.

Clearing and Reducing Bromide Prints.

In clearing up and brightening up a bromide print, removing surface-markings or yellow stains or slight fog, the following bath will be found of great service. It should be applied after fixing and washing, the prints being left in until the desired clearing has taken place, and then removed and well washed :—

Thiocarbamide	20 grs.	4.6 gms.
Citric acid	10 „	2.3 „
Water	10 ozs.	1000 c.c.s.

This bath will not work unless all traces of hypo have been removed from the print.

Bright Prints from Very Weak Negatives.

The following method will be found to give bright vigorous prints from flat negatives when every other means has failed :—

Expose the bromide paper in the usual way, developing it as long as any increase in depth is seen to be gained, ignoring altogether the discolouration of the high-lights—over-develop it, in fact. After fixing and washing, pour over it the following reducing solution until it is seen to be considerably lighter ; when it is, at once plunge into clean hypo for a few minutes. If it is not yet light enough it may be again washed, treated with reducer, and fixed. When it is seen that any further reduction will render the blacks grey, it is washed and dried. Many a negative otherwise quite useless may in this way be saved :—

Potassium iodide	30 grs.
Water	10 ozs.
Iodine	3 grs.

With this bath the whites of the print will assume a dark blue tint, owing to the formation of iodide of starch due to the sizing of the paper ; this immediately vanishes upon placing in the hypo solution.

Line Drawings in Pen and Ink.

Bromide paper will be found to be very handy for this purpose. If we have a negative of some subject from which we wish to make a line drawing in pen and ink, we first make a bromide print, previously well hardened in an alum bath. This is then gone over with a pen, using the indelible India ink sold at most artists' material shops for the use of draughtsmen. The line drawing is made on the surface of the print with this ink, and then, when dry, the whole of the silver image is removed, either by the action of the reducer just described and hypo, or by the following bath, which will of itself entirely remove the image in from a quarter to half an hour, leaving the line drawing untouched :—

Thiocarbamide	120 grs.
Nitric acid	2 drachms
Water...	10 ozs.

"Wellington" S.C.P. (Slow Contact Paper).

Metol-Hydrokinone Developer.

Metol	10 grs.
Hydrokinone	30 ,,
Sulphite of soda (cryst.)	350 ,,
Carbonate of soda (cryst.)	350 ,,
Bromide of potassium	3 ,,
Water...	10 ozs.

Dissolve the above in the order named.

(This developer keeps indefinitely in well stoppered bottles.)

Using the above developer exactly as given, fine blue-black tones may be obtained. If softer results are required, expose the print a little longer and dilute the developer with a further 10 ozs. of water.

For very brilliant blue-black tones we recommend the following :—

Amidol Developer.

Sulphite of soda	500 grs.
Amidol	50 ,,
Bromide of potassium	2 ,,
Water...	10 ozs.

This developer only keeps three days; after that time it should be discarded and fresh made up.

Wellington Ordinary P.O.P.

The prints must be thoroughly well washed, for at least 10 minutes, in many changes of water previous to toning.

Toning.—The following baths are equally good for obtaining most lovely warm or purple tones :—

Formate Toning Bath.

Sodium formate	15 grs.
Sodium bicarbonate	3 ,,
Gold chloride	2 ,,
Water (distilled)	40 ozs.

The bath is ready for use as soon as made up; it will not keep.

Print rather darkly, wash the prints well to thoroughly remove the free chloride. The quantity given above is sufficient to tone two full quire sheets of paper, and should be made up half an hour before using. It will not keep.

Caution.—Do not overtone. Well rinse and fix. The alum bath is only necessary when the prints have to be squeegeed on to glass ; the formate and phosphate baths have no softening effect whatever on the gelatine, as is the case with sulphocyanide, and it is most important to keep the bath slightly alkaline with bicarbonate of soda, as it gets acid with use, owing to the formation of formic acid.

Phosphate Toning Bath.

Phosphate of soda	60 grs.
Gold chloride	2 „
Water...	40 ozs.

This bath should be allowed to stand 1 hour before using ; it will not keep. The above quantity is sufficient for 24 half-plates.

Caution.—Care should be taken not to overtone, as prints become darker when dry. Judge the tone by the surface of the print and not by looking through it. For warm tones the prints must be decidedly red on leaving the toning bath ; for purple tones there should be still a slight trace of red left.

The prints must now be well washed and then fixed in the following bath, where they should remain for not less than 10 minutes.

Fixing Bath.

Sodium hyposulphite	2 ozs.
Water	20 „

After fixing, wash thoroughly in running water for at least 1 hour. The prints may then be hung up to dry by means of clips, or to obtain a highly-glazed surface, squeegee them on to a ferrotype plate and there allow to remain until dry. On no account should they be placed between blotting-paper.

SPECIAL P.O.P. FOR SULPHOCYANIDE BATH ONLY.

Well wash the prints previous to immersion in the toning bath.

Ammonium sulphocyanide	20 grs.
Gold chloride	2 „
Water...	16 ozs.

The tone is to be entirely judged by the surface, and not by looking through the print. Always undertone, as the finished print becomes very much colder when dry. Fix in hyposulphite of soda, 1 oz. to 1 pint of water, allowing 15 minutes for complete fixation.

"WELLINGTON" SELF-TONING PAPER.

Print as for P.O.P.

Immerse prints direct, without washing, for 20 to 30 seconds, in the following :—

Ammonium sulphocyanide	20 grs.
Water	20 ozs.

Wash for 5 minutes in running water, and fix in—

Hypo ...	...	3 ozs.
Water...	...	20 ,,

After which wash thoroughly and hang up to dry.

For warm brown tones, simply place in fixing bath as under for 15 minutes—

Hypo ...	...	2 ozs.
Water...	...	20 ,,

Wash and dry as above.

WRATTEN & WAINWRIGHT'S FORMULÆ.

Developing Formulæ.

Ten per cent. Pyro and Ammonia.

A.	Liquor ammoniæ ...	1 oz.	100 c.c.s.
	Bromide potassium* ...	100 grs.	21 gms.
	Water ...	10 ozs.	1000 c.c.s.
B.	Pyro ...	1 oz.	100 gms.
	Citric acid ...	60 grs.	12 ,,
	Or—		
	Sulphuric acid ...	½ drachm	6 c.c.s.
	Water ...	10 ozs.	1000 ,,

* For use with "I.D.S.," "Speed," or Colour-Sensitive Plates, the bromide in solution A should read—

Bromide potass... ...	110 grs.	22 gms.

For instantaneous and ordinary take from 60 (3 c.c.s.) to 90 minims (5 c.c.s.), and for "I.D.S.," "Speed," and Colour-Sensitive plates 90 minims (5 c.c.s.) of solution B, dilute with from 2 to 4 ozs. (60 to 120 c.c.s.) of water, and add 100 minims (6 c.c.s.) of solution A.

It is better to add solution A by instalments as development proceeds, unless the exposure is known to be either insufficient or quite accurate, in which cases it may be in one quantity.

Pyro Soda.

We recommend this developer for studio and hand-camera work.

No. 1.	Sulphite soda ...	6 ozs.	75 gms.
	Water ...	80 ,,	1000 c.c.s.
	Sulphuric acid or citric acid...	1 drachm	1.5 c.c.
	Pyro ...	1 oz.	13 gms.
No. 2.	Soda carbonate...	6 ozs.	75 ,,
	Water ...	80 ,,	1000 c.c.s.

For use, take equal parts of Nos. 1 and 2.

For denser negatives use the following more concentrated developer:—

3.	Sulphite soda ...	6 ozs.	100 gms.
	Water ...	60 ,,	1000 c.c.s.
	Sulphuric acid or citric acid...	1 drachm	2 c.c.s.
	Pyro ...	1 oz.	17 gms.

4.	Soda carbonate ...	6 ozs.	100 gms.
	Water	60 ,,	1000 c.c.s.

Take equal parts of Nos. 3 and 4.

METOL.

A.	Metol	50 grs.	10 gms.
	Water	10 ozs.	1000 c.c.s.

When dissolved, add—

B.	Soda sulphite	1 oz.	100 gms.
	Soda carbonate	2 ozs.	200 ,,
	Or—		
	Potass carbonate	1 oz.	100 gms.
	Water	10 ozs.	1000 c.c.s.

C. *Ten per cent. Potass Bromide Solution.*

Potass bromide	1 oz.	100 gms.
Water	10 ozs.	1000 c.c.s.

Mix 6 drms. A with 1 drm. B, dilute 1 ounce of water, and add 20 minims (1.5 c.c.s.) 10 per cent. bromide solution C.

If more density and contrast be required, use the solution more concentrated, dilution giving softness according to its degree.

ORTOL.

A.	Water	10 ozs.	1000 c.c.s.
	Potass metabisulphite... ...	35 grs.	7.5 gms.
	Ortol	70 ,,	15 ,,
B.	Water	10 ozs.	1000 c.c.s.
	Carbonate soda...	1¼ oz.	120 gms.
	Sulphite soda	1¾ ,,	180 ,,

Take equal parts A and B.

The above is an excellent developer, not inclined to stain, and very sensitive to the addition of bromide.

When developing "I.D.S.," "Speed," or Colour-sensitive plates, we recommend the addition of, say, 5 minims (.3 c.c.s.) of 10 per cent. potass bromide solution.

CHAS. ZIMMERMANN & CO.

"AGFA" ISOLAR PLATES.

Rodinal Developer.

In cases of normal exposure develop with—

Rodinal	1 part
Water	20 parts

In case of over-exposure with—

Rodinal	1 part
Water	10—20 parts

(adding an ample quantity of solution of potassium bromide, 1 : 10), and in case of under-exposure use—

Rodinal	1 part
Water	20—40 parts

Pyro-Soda Developer.

A. Water, boiled or distilled	...	60 ozs.	1000 c.c.s.
Sulphite of soda crystals	...	6 ,,	100 gms.
When dissolved add—			
Sulphurous acid	... ...	30 drops	15 drops
And then—			
Pyrogallic acid...	... ...	1 oz.	14 gms.
B. Carbonate of soda crystals	...	6 ozs.	100 gms.
Water, boiled or distilled	...	60 ,,	1000 c.c.s.

For general work use equal parts of A and B. To each ounce of mixed developer add 5 drops of a 10 per cent. solution of bromide of potassium.

If development has been performed with an alkaline developer, such as rodinal, eikonogen, metol, pyro, etc., the negative will be quite clear after fixing; but should ferrous oxalate or amidol have been used, there will in all probability be a red colouring of the gelatine, in which case, after fixing, give the plate a five minutes' wash and transfer to a bath of soda carb. 10 per cent. for seven minutes, wash again and replace in the acid fixing bath for ten minutes, and then wash as usual.

When being subsequently intensified or reduced the red colour may reappear, especially when mercury intensification is being employed. In such a case immerse the plate in a 10 per cent. soda carb. solution for seven minutes, and then wash until the colour has gone (about one hour).

"Agfa" Lantern Plates.

Rodinal Developer.

Rodinal	... ...	1 part.
Water	... ...	30—40 parts.

Fix in an acid fixing bath.

The fixed picture will usually be found to have a slight colouration, which must be removed by the following operation:—Thoroughly rinse the plate after fixing, and immerse in soda carbonate 10 per cent. solution for five minutes. The colour will increase in this bath, but disappear entirely after a further wash and immersion in the acid fixing bath, after which wash as usual and then dry.

"Agfa" Chromo Plates.

Metol Hydroquinone.

We have found that the following formula is the best for these plates, giving brilliant vigorous negatives:—

Water	... ...	$31\frac{1}{4}$ ozs.	1000 c.c.s.
Metol	... ...	15 grs.	5 gms.
Hydroquinone	... ...	23 ,,	7.5 ,,
Soda sulphite	... ...	$3\frac{1}{8}$ ozs.	100 ,,
Potass carb.	... ...	$\frac{1}{4}$ oz.	20 ,,
Potass brom.	... ...	3 grs.	1 gm.

For a somewhat softer-working developer, giving fine harmonious gradation, we advocate the well-known rodinal, which for normal exposures should be diluted with 20 parts of water.

After vigorous washing fix in an acid fixing bath, such as the Agfa fixing salts.

"Crossed Swords" Platino Matt P.O.P.

Toning Baths.

Carbon Red Tones.

Water	19 ozs.	1000 c.c.s.
Borax	41 grs.	5 gms.
Chloride of gold	1 gr.	.12 gm.

Must be made up two hours before use, but does not keep well.

Print to about required colour, not too deeply, wash in three changes of water, immerse in :—water 20 ozs., salt 2 drams, until the print has turned orange yellow. Wash once and then tone. When a very slightly lighter colour than desired is obtained, replace in the salt solution for five minutes, rinse and fix in :—hypo 2 ozs., water 40 ozs., freshly made.

Carbon Purple and Violet Tones.

Water	9 ozs.	250 c.c.s.
Hydrochloric acid	3 ,,	85 ,,
Gold chloride	3 grs.	.2 gm.

Print very deeply, wash thoroughly, and tone until desired colour is reached. Wash again and fix in :—hypo 2 ozs., water 40 ozs.

Less acid gives bluish violet. More acid gives red violet—purple.

Toning may be stopped at any stage.

MISCELLANEOUS INFORMATION.

LIST OF THE PRINCIPAL WORKS ON PHOTOGRAPHY.

[The books mentioned below are obtainable by order of all photographic dealers.]

Elementary and General Text-books.

Burton's Modern Photography. By W. K. Burton. 1*s.*

Elementary Photography. By John A. Hodges. 1*s.*

Ilford Manual of Photography. By C. H. Bothamley, F.C.S. 1*s.*

Early Work in Photography. By W. Ethelbert Henry, C.E. 1*s.*

Photography in a Nutshell. By the Kernel. 1*s.*

The Figures, Facts, and Formulæ of Photography. By H. Snowden Ward. 1*s.*

Photographic Reference Book. By J. McIntosh. 1*s.* 6*d.*

The Science and Practice of Photography. By Chapman Jones. 5*s.*

Instruction in Photography. By Sir William Abney. 11th Edition. Revised and enlarged. 7*s.* 6*d.*

Dictionary of Photography. By E. J. Wall. 7*s.* 6*d.*

Photography: Its History, Processes, Apparatus, and materials. By A. Brothers. 21*s.*

Photographic Optics and Chemistry.

Optics for Photographers. By W. K. Burton. 1*s.*
Photographic Lenses: How to Choose and How to Use. By John A. Hodges. 2*s.*
Photographic Lenses. By Conrad Beck and Herbert Andrews. 1*s.*
The Lens. By Thos. Bolas and George E. Brown. 2*s.* 6*d.*
The Optics of Photography and Photographic Lenses, By J. Traill Taylor. 3*s.* 6*d.*
Photographic Optics, a Treatise on. By R. S. Cole. 6*s.*
Photographic Optics. By Otto Lummer. Translated by Silvanus Thompson. 6*s.*
First Book of the Lens. By C. Welborne Piper. 2*s,* 6*d.*
Telephotography. By T. R. Dallmeyer. 21*s.*
Elementary Telephotography. By Ernest Marriage. 3*s.* 6*d.*
Lens-work for Amateurs. By Henry Orford. 3*s.*
Tables of Conjugate Foci. For the Users of Photographic Lenses. Compiled and Explained by J. R. Gotz, F.R.P.S. 2nd Edition. 6*d.*

Chemistry for Photographers. By Charles F. Townsend, F.C.S., F.R.P.S. 1*s.*
The Chemistry of Photography. By R. Meédo'a. 6*s.*

Art, Portraiture, Hand-camera Work, etc.

Naturalistic Photography. By Dr. P. H. Emerson. 3rd Edition. Revised, enlarged and re-written. 5*s.*
Picture-making by Photography. By H. P. Robinson. 2*s.* 6*d.*
Practical Essays on Art. By John Burnet. 1. Composition. 2 Light and Shade. 3. The Education of the Eye. 2*s.* 6*d.*
Art Photography. By H. P. Robinson. 1*s.*
Photography on Tour. 1*s.*
Practical Landscape Photography. By G. T. Harris. 1*s.*
The Photographic Studio. A guide to its construction, etc. By T. Bolas. 2*s.*
Artistic Lighting. By James Inglis. 2*s.* 6*d.*
The Lighting in Photographic Studios. By P. C. Duchochois. Revised, with additional matter by W. Ethelbert Henry, C.E. 1*s.*
Advanced Hand-Camera Work and Focal-Plane Photography. By W. Kilbey. 1*s.*
Instantaneous Photography. By Sir William Abney, F.R.S. 1*s.*
Stereoscope and Stereoscopic Photography. From the French of F. Drouin. 2*s.*
Photo-micrography. By E. J. Spitta. 12*s.*
Practical Photo-micrography. By Andrew Pringle. 3*s.* 6*d.*

Negative Processes.

Wet-collodion Photography. By Charles W. Gamble. 1*s.*
Action of Light in Photography. By Sir Wm. Abney, F.R.S. 3*s.* 6*d.*
Negative-making. By Sir William Abney, F.R.S. 1*s.*
The Watkins' Manual. By Alfred Watkins. 1*s.*
Photography by Rule. By J. Sterry. 1*s.*
Finishing the Negative. By George E. Brown. 2*s.* 6*d.*

Retouching. By Arthur Whiting. 1*s.*
Art of Retouching. By J. Hubert. 1*s.*
Art of Retouching Negatives, and Finishing and Colouring Photographs. By Robert Johnson. 2*s.*
Practical Orthochromatic Photography. By Arthur Payne, F.C.S. 1s.
Photography in Colours. By Bolas, Tallent and Senior. 5*s.*
Three-colour Photography. By Baron von Hübl. 7*s.* 6*d.*

Printing Processes.

Photographic and Photo-mechanical Printing Processes. By W. K Burton. 4*s.*
Bromide Enlarging and Contact Printing. By S. Herbert Fry. 6*d.*
Toning Bromide Prints. By R. Blake-Smith. 1*s.*
Toning Bromides. By C. W. Somerville. 1*s.*
Photographic Enlargements: How to Make Them. By Geo. Wheeler. 1*s.*
Practical Photographic Enlarging. By John A. Hodges. 1*s.*
ABC Guide to Autotype Permanent Photography. By J. R. Sawyer. With Autotype Frontispiece. 2*s.* 6*d.*
Carbon Printing. By E. J. Wall. 1*s.*
Photo-aquatint, or Gum Bichromate Process. By Alfred Maskell and R. Demachy. 1*s.*
Platinotype: Its Preparation and Manipulation. By Sir William Abney and Lyonel Clark. 2*s.* 6*d.*
Ferric and Heliographic Processes. By George E. Brown, F.I.C. 2*s.*
Photographic Reproduction Processes. By P. C. Duchochois. A treatise on photographic impressions without silver salts. 2*s.* 6*d.*
Photo-ceramics. Photography applied to the decoration of plaques, pottery, and other ceramic and metallic surfaces. By W. Ethelbert Henry, C.E., and H. Snowden Ward. 1*s.*
Enamelling and Retouching. By Piquepe. 2*s.* 6*d.*
The Photographic Colourist. By J. W. Neville. 6*d.*

Lanterns and Lantern Slides.

Modern Magic Lanterns. By R. Child Bayley. 1*s.*
The Lantern, and How to Use It. By Goodwin Norton. 1*s.*
Optical Projection. A treatise on the use of the lantern in exhibition and scientific demonstration. By Lewis Wright. 6*s.*
The Optical Lantern: for Instruction and Amusement. By Andrew Pringle, F.R.M.S. 2*s.* 6*d.*
Lantern Slide Making. By Rev. F. C. Lambert. 1*s.*
Living Pictures. By H. V. Hopwood. 2*s.* 6*d.*
Animated Photography. By Cecil M. Hepworth. 1*s.*

Photo-Mechanical Processes.

Half-tone Process on the American Basis. By Wm. Cronenberg. 2*s.*
A Treatise on Photogravure in Intaglio. By the Talbot Klic process. By Herbert Denison, F.R.P.S. 4*s.* 6*d.*
Photo-mechanical Processes. By W. T. Wilkinson. 5*s.*

Photo-lithography. By George Fritz. Translated by E. J. Wall. 3s. 6d.

Half-tone Process. On Zinc and Copper. By Julius Verfasser. 5s.

Photo-aquatint and Photogravure. A practical treatise with many illustrations, and photo-aquatint plate by the author. By Thomas Huson, R.I. 2s.

Professional Photography. By C. H. Hewitt. Vol. I., 1s. Vol. II., 1s.

Photography for the Press. By the Editors of *The Photogram.* 1s.

Practical Radiography. A handbook of the applications of the X-rays. With Illustrations. Third Edition. By A. W. Isenthal and H. Snowden Ward. 6s.

THE COPYRIGHT (WORKS OF ART) ACT (1862).

An Act for amending the Law relating to Copyright in Works of the Fine Arts, and for repressing the Commission of Fraud in the Production and Sale of such Works.

WHEREAS by law, as now established, the authors of paintings, drawings, and photographs, have no copyright in such their works, and it is expedient that the law should in that respect be amended: Be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

Copyright in Works Hereafter Made or Sold to Vest in the Author for his Life, and for Seven Years after his Death.

1. The author, being a *British* subject or resident within the dominions of the Crown, of every original painting, drawing, and photograph which shall be or shall have been made either in the *British* dominions or elsewhere, and which shall not have been sold or disposed of before the commencement of this Act, and his assigns, shall have the sole and exclusive right of copying, engraving, reproducing and multiplying such painting or drawing, and the design thereof, or such photograph, and the negative thereof, by any means and of any size, for the term of the natural life of such author, and seven years after his death; provided that when any painting or drawing, or the negative of any photograph, shall for the first time after the passing of this Act be sold or disposed of, or shall be made or executed for or on behalf of any other person for a good or a valuable consideration, the person so selling or disposing of or making or executing the same shall not retain the copyright thereof, unless it be expressly reserved to him by agreement in writing, signed, at or before the time of such sale or disposition, by the vendee or assignee

of such painting or drawing, or of such negative of a photograph, or by the person for or on whose behalf the same shall be so made or executed, but the copyright shall belong to the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall have been made or executed; nor shall the vendee or assignee thereof be entitled to any such copyright, unless, at or before the time of such sale or disposition, an agreement in writing, signed by the person so selling or disposing of the same, or by his agent duly authorised, shall have been made to that effect.

Copyright not to prevent the Representation of the Same Subjects in Other Works.

2. Nothing herein contained shall prejudice the right of any person to copy or use any work in which there shall be no copyright, or to represent any scene or object, notwithstanding that there may be copyright in some representation of such scene or object.

Assignments, Licenses, etc., to be in Writing.

3. All copyright under this Act shall be deemed personal or moveable estate, and shall be assignable at law, and every assignment thereof, and every license to use or copy by any means or process the design or work which shall be the subject of such copyright, shall be made by some note or memorandum in writing, to be signed by the proprietor of the copyright, or by his agent appointed for that purpose in writing.

Register of Proprietors of Copyrights in Paintings, Drawings, and Photographs to be kept at Stationers' Hall, as in 5 & 6 Vict., cap. 45.

4. There shall be kept at the Hall of the Stationers' Company, by the Officer appointed by the said Company for the purposes of the Act passed in sixth year of Her present Majesty, intituled *An Act to Amend the Law of Copyright,* a book or books, entitled "The Register of Proprietors of Copyright in Paintings, Drawings, and Photographs," wherein shall be entered a memorandum of every copyright to which any person shall be entitled under this Act, and also of every subsequent assignment of any such copyright; and such memorandum shall contain a statement of the date of such agreement or assignment, and of the names of the parties thereto, and of the name and place of abode of the person in whom such copyright shall be vested by virtue thereof, and of the name and place of abode of the author of the work in which there shall be such copyright, together with a short description of the nature and subject of such work and in addition thereto, if the person registering shall so desire, a sketch, outline, or photograph of the said work, and no proprietor of any such copyright shall be entitled to the benefit of this Act until such registration, and no action shall be sustainable nor any penalty recoverable in respect of anything done before registration.

Certain Enactments of 5 & 6 Vict., c. 45, to Apply to the Books to be Kept under this Act.

5. The several enactments in the said Act of the sixth year of Her present Majesty contained, with relation to keeping the register book thereby required, and the inspection thereof, the searches therein, and the delivery of certified and stamped copies thereof, the reception of such copies in evidence, the making of false entries in the said book, and the production in evidence of papers falsely purporting to be copies of entries in the said book, the application to the Courts and Judges by persons aggrieved by entries in the said book, and the expunging and varying such entries, shall apply to the book or books to be kept by virtue of this Act, and to the entries and assignments of copyright and proprietorship therein under this Act, in such and the same manner as if such enactments were here expressly enacted in relation thereto, save and except that the forms of entry prescribed by the said Act of the sixth year of Her present Majesty may be varied to meet the circumstances of the case, and that the sum to be demanded by the officer of the said Company of Stationers for making any entry required by this Act shall be one shilling only.

Penalties on Infringement of Copyright.

6. If the author of any painting, drawing, or photograph in which there shall be subsisting copyright, after having sold or disposed of such copyright, or if any other person, not being the proprietor for the time being of copyright in any painting, drawing, or photograph, shall, without the consent of such proprietor, repeat, copy, colourably imitate, or otherwise multiply for sale, hire, exhibition, or distribution, or cause or procure to be repeated, copied, colourably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution, any such work or the design thereof, or, knowing that any such repetition, copy, or other imitation has been unlawfully made, shall import into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be imported, sold, published, let to hire, distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of the said work, or of the design thereof, made without such consent as aforesaid, such person for every such offence shall forfeit to the proprietor of the copyright for the time being a sum not exceeding ten pounds; and all such repetitions, copies, and imitations, made without such consent as aforesaid, and all negatives of photographs made for the purpose of obtaining such copies, shall be forfeited to the proprietor of the copyright.

Penalties on Fraudulent Productions and Sales.

7. No person shall do or cause to be done any or either of the follow Acts: that is to say,—

First, no person shall fraudulently sign or otherwise affix, or

fraudulently cause to be signed or otherwise affixed to or upon any painting, drawing, or photograph, or the negative thereof, any name, initials, or monogram:

Secondly, no person shall fraudulently sell, publish, exhibit, or dispose of, or offer for sale, exhibition, or distribution, any painting, drawing, or photograph, or negative of a photograph, having thereon the name, initials, or monogram, of a person who did not execute or make such work:

Thirdly, no person shall fraudulently utter, dispose, or put off, or cause to be uttered or disposed of, any copy or colourable imitation of any painting, drawing, or photograph, or negative of a photograph, whether there shall be subsisting copyright therein or not, as having been made or executed by the author or maker of the original work from which such copy or imitation shall have been taken.

Fourthly, where the author or maker of any painting, drawing, or photograph, or negative of a photograph, made either before or after the passing of this Act, shall have sold or otherwise parted with the possession of such work, if any alteration be afterwards made therein by any other person, by addition or otherwise, no person shall be at liberty, during the life of the author or maker of such work, without his consent, to make or knowingly to sell or publish, or offer for sale, such work or any copies of such work so altered as aforesaid, or of any part thereof, as or for the unaltered work of such author or maker.

Penalties.

Every offender under this section shall, upon conviction, forfeit to the person aggrieved a sum not exceeding ten pounds, or not exceeding double the full price, if any, at which all such copies, engravings, imitations, or altered works shall have been sold or offered for sale; and all such copies, engravings, or imitations, or altered works shall be forfeited to the person, or the assigns, or legal representatives of the person whose name, initials, or monogram shall be so fraudulently signed or affixed thereto, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid: Provided always, that the penalties imposed by this section shall not be incurred unless the person whose name, initials, or monogram shall be so fraudulently signed or affixed, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid, shall have been living at or within twenty years next before the time when the offence may have been committed.

Recovery of Pecuniary Penalties.

8. All pecuniary penalties which shall be incurred, and all such unlawful copies, imitations, and all other effects and things as shall have been forfeited by offenders, pursuant to this Act, and pursuant to any Act for the protection of copyright engravings, may be recovered by the person hereinbefore and in any such Act

as aforesaid empowered to recover the same respectively, and hereinafter called the complainant or the complainer, as follows:

In *England* and *Ireland*, either by action against the party offending or by summary proceeding before any two Justices having jurisdiction where the party offending resides:

In *Scotland*, by action before the Court of Session in ordinary form, or by summary action before the Sheriff of the County where the offence may be committed or the offender resides, who, upon proof of the offence or offences, either by confession of the party offending or by the oath or affirmation of one or more credible witnesses, shall convict the offender, and find him liable to the penalty or penalties aforesaid, as also in expenses; and it shall be lawful for the Sheriff, in pronouncing such judgment for the penalty or penalties and costs, to insert in such judgment a warrant, in the event of such penalty or penalties and costs not being paid, to levy and recover the amount of the same by poinding: Provided always, that it shall be lawful to the Sheriff, in the event of his dismissing the action and assoilising the defender, to find the complainer liable in expenses, and any judgment as to be pronounced by the Sheriff in such summary application shall be final and conclusive, and not subject to review by advocation, suspension, reduction, or otherwise.

Superior Courts of Record in which any Action is Pending may Make an Order for an Injunction, Inspection, or Account.

9. In any action in any of Her Majesty's Superior Courts of Record at *Westminster* and in *Dublin*, for the infringement of any such copyright as aforesaid, it shall be lawful for the Court in which such action is pending, if the Court be then sitting, or if the Court be not sitting then, for a judge of such Court, on the application of the plaintiff or defendant respectively, to make such order for an injunction, inspection, or account, and to give such direction respecting such action, injunction, inspection, or account, and the proceedings therein respectively, as to such Court or Judge may seem fit.

Reproduction Fees.

The Copyright Union has drawn attention to the following suggestions, drawn up for the guidance of its members, by Mr. Alfred Ellis:—

Members are advised not to give permission for their copyright photographs to be reproduced until they have full particulars of the size and style of the proposed reproduction, when they can formulate their charges accordingly. For example: a newspaper should pay a fee of not less than 10s. 6d. for half-tone black-and-white reproduction not exceeding 6 by 4 inches, when printed with letterpress in one issue of a newspaper; but, if it is to be printed as an inset the fee should be at least one guinea. If printed in colours, colotype, or photogravure, it should be a still higher fee. If a photograph is to be reproduced for advertis-

ing purposes, a higher fee should be charged than for newspaper work. In all cases, the permission must be in writing, and should state the fee to be paid, the process by which the photograph is to be reproduced, and whether in black-and-white or colours, the size limit, and the purpose for which the reproduction may be used.

The fee for reproduction on postcards should be not less than 10s. 6d. royalty per thousand for half-tone or collotype, and £1 1s. per thousand for bromide or ordinary photographic processes.

THE POISONS ACT.

The following is a list of poisons scheduled in the Poisons Act.

Schedule A.

Part 1.—Arsenic, and its preparations; aconite, and its preparations; alkaloids—all poisonous vegetable alkaloids and their salts; preparations of atropine; cantharides; corrosive sublimate; cyanides of potassium, and all metallic cyanides and the preparations of such articles; emetic tartar; ergot of rye, and its preparations; prussic acid, and its preparations; savin, and its oil; strychnine, and its preparations.

Part 2.—Essential oil of almonds (unless deprived of its prussic acid); belladona, and its preparations; tincture and all vesicating liquid preparations of cantharides; liquid preparations of carbolic acid, and homologues (if containing more than 3 per cent. of such substances); chloroform; chloral hydrate, and its preparations; preparations of corrosive sublimate; preparations of morphine; nux vomica, and its preparations; opium, and all preparations of opium or of poppies; oxalic acid; red precipitate (red oxide of mercury); white precipitate (ammoniated mercury). Cocaine and its salts, picrotoxin, preparations of cocaine, digitalis and its preparations, mercuric iodide, mercuric sulphocyanide, stropanthus and ts preparations.

These poisons must not be sold by any except certified pharmacists under penalty of £5 for each offence. Poisons sold either retail or wholesale must be distinctly labelled with the name of the poison, the name and address of the seller, and the word "poison." In the case of the poisons in Part 1, it is forbidden to sell the same to any person unknown to the seller unless introduced by a person known to the seller, and on every sale the seller shall, before delivery, have entered in a book for the purpose the date of sale, name and address of the purchaser, name and quantity of the article sold, and the purpose for which it is required, to which entry the purchaser shall attach his signature.

THE PATENTS ACT.

Chapter 34.

An Act to amend the Law with reference to Applications for Patents and Compulsory Licences, and other matters connected therewith.

[18th December, 1902.]

BE it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1.—(1) Where an application for a patent has been made and a complete specification has been deposited by the applicant, the examiner shall forthwith, in addition to the inquiries which he is directed to make by the Patents, Designs, and Trade Marks Act, 1883 (in this Act referred to as the principal Act), make a further investigation for the purpose of ascertaining whether the invention claimed has been wholly or in part claimed or described in any specification (other than a provisional specification not followed by a complete specification) published before the date of the application, and deposited pursuant to any application for a patent made in the United Kingdom within fifty years next before the date of the application.

(2) If on investigation it appears that the invention has been wholly or in part claimed or described in any such specification, the applicant shall be informed thereof, and the applicant may, within such time as may be prescribed, amend his specification, and the amended specification shall be investigated in like manner as the original specification.

(3) The examiner shall report to the comptroller the result of his investigations in such manner as the Board of Trade may direct.

(4) The provisions of subsection five of section nine of the principal Act, as amended by any subsequent enactment, shall apply to reports under this section.

(5) If the comptroller is satisfied that no objection exists to the specification on the ground that the invention claimed thereby has been wholly or in part claimed or described in a previous specification as before mentioned, he shall, in the absence of any other lawful ground of objection, accept the specification.

(6) If the comptroller is not so satisfied, he shall, after hearing the applicant, and unless the objection be removed by amending the specification to the satisfaction of the comptroller, determine whether a reference to any, and, if so, what, prior specifications ought to be made in the specification by way of notice to the public.

(7) An appeal shall lie from the decision of the comptroller under this section to the law officer.

(8) Section eight of the principal Act and section three of the Patents, Designs, and Trade Marks (Amendment) Act, 1885 (which regulate the time for depositing a complete specification), shall have effect as if references therein to the period of nine months were references to the period of six months.

(9) The investigations and reports required by this section shall not be held in any way to guarantee the validity of any patent, and no liability shall be incurred by the Board of Trade or any officer thereof by reason of, or in connection with, any such investigation or report, or any proceeding consequent thereon.

(10) The Board of Trade, with the sanction of the Treasury, may prescribe an additional fee not exceeding one pound in respect of the investigation mentioned in this section, which shall be payable on the sealing of the patent.

(11) This section shall come into operation at such date as the Board of Trade may by order direct, and shall apply only to applications made after that date, and the order shall be laid before both Houses of Parliament.

2. An invention covered by any patent granted on an application to which section one of this Act applies shall not be deemed to have been anticipated by reason only of its publication in a specification deposited pursuant to an application made in the United Kingdom not less than fifty years before the date of the application to a patent therefor, or of its publication in a provisional specification of any date not followed by a complete specification.

3. Section twenty-two of the principal Act (relating to the grant of compulsory licences by the Board of Trade) is hereby repealed, and the following provisions shall be substituted therefor:—

(1) Any person interested may present a petition to the Board of Trade alleging that the reasonable requirements of the public with respect to a patented invention have not been satisfied, and praying for the grant of a compulsory licence, or, in the alternative, for the revocation of the patent;

(2) The Board of Trade shall consider the petition, and if the parties do not come to an arrangement between themselves, the Board of Trade, if satisfied that a primâ facie case has been made out, shall refer the petition to the Judicial Committee of the Privy Council, and, if the Board are not so satisfied, they may dismiss the petition.

(3) Where any such petition is referred by the Board of Trade to the Judicial Committee, and it is proved to the satisfaction of the Judicial Committee that the reasonable requirements of the public with reference to the patented invention have not been satisfied, the patentee may be ordered by an Order in Council to grant licences on such terms as the said Committee may think just, or, if the Judicial Committee are of opinion that the reasonable requirements of the public will not be satisfied by the grant of licences, the patent may be revoked by Order in Council;

Provided that no order of revocation shall be made before the expiration of three years from the date of the patent, or if the patentee gives satisfactory reasons for his default;

(4) On the hearing of any petition under this section the patentee and any person claiming an interest in the patent as exclusive licensee or otherwise, shall be made parties to the proceeding, and the law officer or such other counsel as he may appoint shall be entitled to appear and be heard;

(5) If it is proved to the satisfaction of the Judicial Committee that the patent is worked or that the patented article is manufactured exclusively or mainly outside the United Kingdom, then, unless the patentee can show that the reasonable requirements of the public have been satisfied, the petitioner shall be entitled either to an order for a compulsory licence, or, subject to the above proviso, to an order for the revocation of the patent;

(6) For the purposes of this section the reasonable requirements of the public shall not be deemed to have been satisfied if, by reason of the default of the patentee to work his patent or to manufacture the patented article in the United Kingdom to an adequate extent, or to grant licences on reasonable terms, (*a*) any existing industry or the establishment of any new industry is unfairly prejudiced, or (*b*) the demand for the patented article is not reasonably met;

(7) An Order in Council directing the grant of any licence under this section shall, without prejudice to any other method of enforcement, operate as if it were embodied in a deed granting a licence, and made between the parties to the proceeding;

(8) His Majesty in Council may make rules of procedure and practice for regulating proceedings before the Judicial Committee under this section, and, subject thereto, such proceedings shall be regulated according to the existing procedure and practice in patent matters. Any Order in Council or any order made by the Judicial Committee under this Act may be enforced by the High Court as if it were an order of the High Court;

(9) The costs of and incidental to all proceedings under this section shall be in the discretion of the Judicial Committee, but in awarding costs on any application for the grant of a licence the Judicial Committee may have regard to any previous request for, of offer of, a licence made either before or after the application to the Committee;

(10) For the purposes of this section three members of the Judicial Committee shall constitute a quorum;

(11) This section shall apply to patents granted before as well as after the commencement of this Act.

4. In subsection four of section eighty-two of the principal Act (which relates to the performance of the duties of the comptroller by other officers under the direction of the Board of Trade) the words "in his absence" shall be repealed.

5. This Act may be cited as the Patents Act, 1902, and may be cited and shall be construed as one with the Patents, Designs, and Trade Marks Acts, 1883 to 1901.

INSURANCE COMPANIES AND EXHIBITIONS OF ANIMATED PHOTOGRAPHY

In view of the increasing number of Exhibitions of animated pictures which are being held, it may be desirable that our readers should know under what conditions Fire Offices allow the use (either temporary or permanent) of cinematographs or similar apparatus. The following have been adopted by Insurance Companies:—

Rules *re* Exhibition of Animated Pictures.

1. The lantern must be constructed of metal or lined with metal and asbestos.

2. An alum or water bath must be used between the condenser and the film.

3. The apparatus must be fitted with a drop shutter available in case of emergency.

4. If the film does not wind upon a reel or spool immediately after passing through the machine, a metal receptacle with a slot in the metal lid must be provided for receiving it.

5. If electric arc lights are used, the installation must be in accordance with the usual rules, *i.e.*, the choking coils and switch to be securely fixed on incombustible basis, preferably on a brick wall, and d.p. safety fuses to be fitted.

6. If oxyhydrogen gas is used, storage must be in metal cylinders only.

7. The use of an ether saturator is not to be permitted under any circumstances.

Position.—Preferably on an open floor with a space of at least six feet all round railed off. If in a compartment, the compartment to be lined with fire-resisting materials. In any case no drapery or combustible hangings to be within two yards.

General.—Fire buckets to be kept filled, and a damp blanket to be provided and placed close at hand.

GEOLOGICAL PHOTOGRAPHS.

A Committee was appointed by the British Association for the Advancement of Science in 1889, for the purpose of arranging for the collection, preservation, and systematic registration of photographs of geological interest in the United Kingdom.

Since its formation the Committee has been successful in obtaining a number of photographs, of which 2000 were received and registered up to the month of August, 1898, when the ninth report was presented at the Bristol meeting of the British Association.

The collection cannot yet be regarded as in any sense complete, for many districts are still poorly represented in it. A great effort is being made to fill up the numerous lacunæ.

The Committee would, therefore, urge upon geologists and photographers the desirability of further assisting the scheme, with the object of completing a national collection of photographs to illustrate the geology of our own country.

The collection has been deposited at the Museum of Practical Geology, 28, Jermyn Street, London, where it is accessible to the public for purposes of reference.

It is desired to obtain photographs illustrative of characteristic rock exposures, especially those of a typical character or temporary nature; important boulders; localities affected by denudation, or where marked physiographical changes are or have been in operation; landslips; raised beaches; old sea-cliffs and other conspicuous instances of marine erosion; characteristic river valleys or escarpments, and the like; types of rock-structure, jointing, folding, and faulting; glacial phenomena, such as *roches moutonnées*, moraines, drums, and eskers; or any natural views of geological interest. Photographs of microscopical sections and typical hand specimens of rocks and fossils are also admissible.

It is important that copies of photographs which have been processed for illustrating articles and papers in journals should be deposited in the collection; they should be accompanied by an exact reference to the publication, and, if possible, a copy of the plate.

Duplicate collections of about 200 prints and about 100 slides have been formed, and the Secretary will gladly forward either or both of them to any local society that contemplates joining in the work, or wishes to see what has already been done.

Apparatus for Geological Photography.

The Committee has had under consideration the question of the most suitable form of camera for geological field work. The following is a *précis* of communications from experts who have been invited to offer suggestions on the subject.

The *best camera* to use is probably that to which the worker is himself most accustomed. These hints are added for those who have not yet adopted any particular camera.

The camera should be as light as possible, but *rigidity* when set up is absolutely necessary.

Double swing-back and rising and falling front are essential, to allow of correct perspective and the true rendering of lines and curves.

The camera should admit of long extension to permit the use of lenses of various *foci*.

It is sometimes desirable to take photographs of inclined or horizontal rock-surfaces at distances of a few feet, for the purpose of showing minor features, such as veins, glacial markings, structures of gneissose rocks, &c. To effect this, two boards hinged together with some arrangement for fixing them at the desired angle are all that is required. The lower board must, of course, be screwed to the stand and the upper one to the camera.

A spirit level should be used with the camera or attached to it.

It is well to have three lenses: (1) A rapid rectilinear doublet of 10 to 12-inch focus (for half-plate size); (2) a wide-angle meniscus, focal length about 6 to 7 inches, for interiors of quarries and craters; and (3) a long-focus lens of focal length equal to three or four times the length of the plate, for distant hills and inaccessible cliffs.

If only one lens is used, it should be a rapid rectilinear of about 9-inch focal length (for half-plate size), and should be by some reputable maker. It must be the best of its kind obtainable. Though films materially decrease the weight to be carried, they are not recommended for general use; plates should be used whenever possible. Good general work can be done with a quarter-plate or 5 x 4 camera, and subsequent enlargement on bromide paper. In this case it is essential that the lens should be of first-rate make, and be used with a small stop. For direct printing, the cold-bath platinotype method is recommended as the most permanent, and it is now very easy to work.

It is advisable, when measurements are unattainable, that a "scale object" should be included in the photograph. (A hammer is sometimes used, but it is not suitable; a walking-stick or a human figure seems to be satisfactory.)

Recommendations for the Collection of Geological Photographs.

(1) Societies are urged to form small committees for the purpose of noting sections suitable to be photographed, and arranging such work as may be possible in each district. To this end it is anticipated that the services of many amateur photographers may be secured.

(2) Size of photograph recommended, 8½ x 6½ inches ("whole-plate"); but this is *optional*. In view of the difficulty of carrying a heavy camera and plates, it is not desired to exclude smaller views when these are well defined and clear. In the case of small negatives, when sharp, an enlargement to whole-plate size is desirable. The views should be printed by a permanent process whenever practicable. Isochromatic plates are strongly recommended.

(3) In order to preserve its scientific value, each photograph should be accompanied by *as many* of the following details *as can be conveniently given*. Forms for this purpose will be supplied on application.

(*a*) Name and position of section or locality.

(*b*) Special features shown, with illustrative diagrams when necessary. (Further details may be given, if more convenient, on a separate tracing.)

(*c*) Height and length of section, and compass direction. If possible, a scale of some kind should always be given.

(*d*) Name and address of photographer, or of the society under whose direction the view is taken.

(*e*) Date when photographed.

(*f*) Indication of direction of light and shade; *i.e.*, state whether taken in "direct light" or "in shade."

(4) Each photograph sent in for registration should bear a *local* number, and the accompanying form should be numbered at the top right-hand corner in accordance therewith.

(5) Photographs should be sent *unmounted*. This is essential in order to secure the proper geographical arrangement of the collection. They will be mounted by the Committee on cards of uniform size, with perforated edges for binding, to hold one whole-plate, two half-plate, or four quarter-plate views.

(6) Copies of photographic prints, lists of photographs, and information relative thereto, should be sent under cover to the Secretary of the Committee, at the earliest possible date, in order to facilitate the work of registration. They should be sent in *not later than August* 1 in each year.

[*Reduced Copy of* FORM A.]

FORM A			Loca No.
BRITISH ASSOCIATION COMMITTEE ON GEOLOGICAL PHOTOGRAPHS.			
County.		Photographed under the direction of	
Name and position of Locality or Section.			
Special features shown.			
Details of Section.	Height.	Compass Direction. Camera Pointing.	"In shade" or "direct light."
	Length.		Time: a.m. p.m.
Sketch, or other particulars, if necessary, may be given here:—			
Name of Photographer.			Registered No.
Address.		Date photographed.	

* This number should also be placed on the back of the Photograph.

NOTE.—Copies of the above Form will be supplied on application to the Secretary, to enable the Donors of Photographs to insert the requisite particulars.

(7) It adds very much to the usefulness of the collection when amateurs are willing to place their negatives, or copies of them, in the hands of a professional photographer, with instructions to supply prints or lantern slides, at a price, to those who apply for them. The Secretary would willingly help in giving advice on this point, as he is frequently asked where copies of the contributed prints can be obtained.

Detailed lists of photographs officially received are published in the annual reports of the Committee, which also states where the photographs may be obtained. These reports are published in the "Annual Report" of the British Association, and a copy will be forwarded to the donor of each photograph.

Further information may be obtained from the members of the Committee, or from the Secretary, W. W. Watts, Mason University College, Birmingham, to whom communications should be addressed.

TABLES.

Weights and Measures.

The formulæ in the editorial pages of this ALMANAC are given n almost all cases, in both British and metric measures, and in adopting this course we have had the desire to impress upon photographers the simplicity and facility of the latter system. As a rule, the British formulæ are expressed in grains or ounces per 20 ozs. of solution, and the metric formulæ in grammes per 1000 c.c.s. In regard to the total bulk of solution, our formulæ are mostly drawn up on the basis that the total bulk after the solution of the solids is that stated in the formula, 20 ozs. or 1000 c.c.s. as a rule. That this is intended is indicated by writing the proportion, of water thus :—" water *to x* ounces."

The question of a 10 per cent. solution is a point in formulæ making and using which has caused endless discussion ; but it is really simple enough if it be borne in mind that the ounce avoirdupois contains 437½ grains while the fluid ounce contains 480 minims. As 10 per cent. solutions, being strong, are usually measured out in minims, the ounce avoirdupois must be dissolved in enough water to make a solution containing 1 grain in 10 minims, that is to say, 4,375 minims, or practically 9 ounces, is the proper bulk for the solution of 1 ounce avoirdupois. But if a solution is to be measured out in fluid ounces, then the 10 per cent. solution will be 1 oz. in 10 fluid ozs.

In regard to the conversion of the British into the metric units it was the intention of the present editor to adopt for the conversion of grains-per-ounce into grammes-per-litre the easy rule of Lord Crawford* as sufficiently accurate in the great majority of cases, and lending itself to the checking of the accuracy of the conversions by inspection. But the fact that a very large number of formulæ are already converted by a distinctly more accurate factor has been sufficient inducement to adopt a more laborious and exact method.

Throughout this work "grains per ounce" are converted into "grammes per litre" by multiplying by 2.3. Ounces per any given

* Divide the number of grains in any solution by half the number of ounces in which they are dissolved and write the result as grammes per litre. Thus :—40 grains in 16 ounces, 40 ÷ 8 = 5 grammes per litre.

number of fluid ounces are converted by taking the same ratio of grammes to 1000 c.c.s.

In reference to the names of chemicals, "sodium carbonate" and "sodium sulphite" are used for the crystallised forms of these substances. If the dry or anhydrous forms are meant, one or other of these terms is used in qualification.

British Weights and Measures.

1. APOTHECARIES WEIGHT.*

20 Grains = 1 Scruple.
3 Scruples = 1 Drachm = 60 Grains.
8 Drachms = 1 Ounce = 480 Grains.

2. AVOIRDUPOIS WEIGHT.*

437½ Grains = 1 Ounce.
16 Ounces = 1 Pound = 7000 Grains.

¼ ounce = 109 grains ; ½ ounce = 219 grains ; ¾ ounce = 328 grains.

3. FLUID MEASURE.

60 Minims = 1 Drachm.
8 Drachms = 1 Ounce = 480 Minims.
20 Ounces = 1 Pint = 160 Drachms = 9600 Minims.
2 Pints = 1 Quart = 40 Ounces = 320 Drachms
4 Quarts = 1 Gallon = 160 Ounces = 1280 Drachms

1 fluid ounce of water weighs 437½ grains, therefore every minim weighs 0.91 grains.

Metric Weights and Measures.

The unit of weight is the gramme, written "gm.," ; the sub-divisions are the "deci-" (1/10th), "centi-" (1/100th), and "milligramme" (1/1000th) ; the multiples are the "deka-" (10 gm.) and "hectogramme" (100 gm.), but in practice it is usual to use the term .1 or .01 and 10 or 100 grammes, and the abbreviation "kilo." for 1000 gms.

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* It is now customary in formulæ to employ the avoirdupois ounce (437½ grains) ; but in cases were "drachms" are given, the apothecaries drachm of 60 grains is taken as the unit.

TABLE FOR CONVERTING GRAINS AND DROPS PER OUNCE INTO GRAMMES AND C.C.S. PER LITRE AND *VICE VERSA.*

1000 : 480	1000 : 437½		437½ : 1000	480 : 1000
3/25	7/64	1/4	4/7	25/48
4/25	7/48	1/3	16/21	25/36
6/25	7/32	1/2	1 1/7	1 1/24
8/25	7/24	2/3	1 11/21	1 7/18
9/25	21/64	3/4	1 5/7	1 9/16
12/25	7/16	1	2 2/7	2 1/12
24/25	7/8	2	4 4/7	4 1/6
1 11/25	1 5/16	3	6 6/7	6 1/4
1 23/25	1 3/4	4	9 1/7	8 1/3
2 2/5	2 3/16	5	11 3/7	10 5/12
2 22/25	2 5/8	6	13 5/7	12 1/2
3 9/25	3 1/16	7	16	14 7/12
3 21/25	3 1/2	8	18 2/7	16 2/3
4 8/25	3 15/16	9	20 4/7	18 3/4
4 4/5	4 3/8	10	22 6/7	20 5/6
5 7/25	4 13/16	11	25 1/7	22 11/12
5 19/25	5 1/4	12	27 3/7	25
6 6/25	5 11/16	13	29 5/7	27 1/12
6 18/25	6 1/8	14	32	29 1/6
7 1/5	6 9/16	15	34 2/7	31 1/4
7 17/25	7	16	36 4/7	33 1/3
8 4/25	7 7/16	17	38 6/7	35 5/12
8 16/25	7 7/8	18	41 1/7	37 1/2
9 3/25	8 5/16	19	43 3/7	39 7/12
9 3/5	8 3/4	20	45 5/7	41 2/3
14 1/25	13 1/8	30	68 4/7	62 1/2
19 1/5	17 1/2	40	91 3/7	83 1/3
24	21 7/8	50	114 2/7	104 1/6
28 4/5	26 1/4	60	137 1/7	125
33 3/5	30 5/8	70	160	145 5/6
38 2/5	35	80	182 6/7	166 2/3
43 1/5	39 3/8	90	205 5/7	187 1/2
48	43 3/4	100	228 4/7	208 1/3
52 1/2	47 109/128	109 3/8	250	227 83/96
57 3/5	52 1/2	120	274 2/7	250
70	63 77/96	145 5/6	333 1/3	307 1/4
76 4/5	70	160	365 5/7	333 1/3
105	95 45/64	218 3/4	500	455 35/48
115 1/5	105	240	548 4/7	500
120	109 3/8	250	571 3/7	520 5/6

When a number in the central column is that of the grains per avoirdupois ounce, the proportionate number of grammes per litre will be found next to it on the *right* hand. When a number in the central column is that of the grammes per litre, the proportionate number of grains per avoirdupois ounce will be found next to it on the *left* hand. Thus, 70 grains per ounce (central column) are equivalent to 160 grammes per litre (right hand). Again, 16 grammes per litre (central column) are equivalent to 7 grains per avoirdupois ounce (left hand). The outer columns may be used in conjunction with the central one in the same way, to convert drops per fluid ounce into c.c.s. per litre, and *vice versa.*

The following are the equivalents of Metric Weights and Measures in terms of Imperial Weights and Measures :—

Linear Measure.

1 Millimetre (mm.) (1/1000th M.)	=	0.03937 Inch
1 Centimetre (1/100th M.) ...	=	0.3937 ,,
1 metre (M.)	=	39.370113 Inches 3.280843 Feet 1.0936143 Yards
Kilometre (1000 M.)	=	0.62137 Mile

Square Measure.

1 Square Centimetre	=	0.155 Square Inch
1 Square Metre (100 Square Decimetres)	=	10.7639 Square Feet 1.196 Square Yards

Cubic Measure.

1 Cubic Centimetre	=	0.061 Cubic Inch
1 Cubic Metre (1000 Cubic Decimetres)	=	35.3148 Cubic Feet 1.307954 Cubic Yards

Weight.

		Avoirdupois.
1 Milligramme (1/1000th Gm.)	=	0.015 Grain
1 Gramme (1 Gm.)	=	15.432 ,,
1 Kilogramme (1000 Gm.) ...	=	2.2046223 lbs. or 15432.3564 Grains
		Apothecaries'.
1 Gramme (1 Gm.)	=	0.2572 Drachm 0.7716 Scruple 15.432 Grains

Fluid Measure.

1 Cubic Centimetre (C.C.) (1/1000th Litre) = 16.9 minims*
1 Litre (1 L.) = 35 ozs. 94 m. = 16894.1 minims

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* *Millilitre and C.C.*—Revisions of metric standards have shown that the litre is not exactly 1000 c.c.s., but 999.84 c.c.s. (according to Mendeeleef's calculations from the experimental data). The difference appears sufficiently serious in official circles to warrant the abandonment of the term "cubic centimetre," and the employment of "millilitre" for the true thousandth part; millilitre to be abbreviated to "mil." On grounds of terminology there is some reason for this, but until "millilitre" commences to oust c.c. from current writings we shall continue to use the latter term. As regards error, the difference is absolutely negligible. The voice of an academician may be raised to deplore the inaccuracy of the present metric system, but a system which is out of truth to the extent only of 4 drops in 35 ounces is good enough surely for every photographic purpose. In the metric measures given above we do not include the academic names centilitre and decilitre for the tenth and hundredth of a litre, as these are never used in practice, and only serve to confuse the student.

COINS AS WEIGHTS.

Silver coinage, it is useful to note, is minted exactly by weight in proportion to its value, viz., 436 $^4/_{11}$ grains for every 5s. Thus the threepenny bit is 21.8 grs.; a sixpence, 43.6; shilling, 87.2; florin, 175.4; half-crown, 218 grs.

Thus the sixpence and threepenny piece are almost exactly one-tenth and one-twentieth of the avoirdupois ounce.

Bronze coinage—

Three pennies, or five half-pennies, or ten farthings = 1 oz. (avoirdupois).

i.e., the penny = 145.8 grs.; 1 half-penny, 87.5; and 1 farthing, 43.75 grs.

One sovereign weighs 123.27 grs.; the half-sovereign, 61·63 grs.

$\frac{1}{4}$ oz. (avoir.) = one half-penny and one threepenny piece.
$\frac{1}{2}$,, ,, = two half-pennies and a farthing.
1 ,, ,, = three pennies (or five half-pennies).
2 ,, ,, = six pennies (or ten half-pennies).
4 ,, ,, = twelve pennies (or twenty half-pennies).

French Coins as Metric Weights.

Lord Crawford gives the following table:—

	Silver Coins.		*Bronze Coins.*
25 gms.... ...	5 francs	10 gms. ...	10 centimes
10 ,, ...	2 ,,	5 ,, ...	5 ,,
5 ,, ...	1 ,,	2 ,, ...	2 ,,
$2\frac{1}{2}$,, ...	$\frac{1}{2}$,, or 50 centimes	1 ,, ...	1 ,,

PARTS.

It is common to express formulæ in "parts," a system which is a stumbling block to many. The following table will enable anyone to convert a formula into the usual grains, ounces, etc. For instance, take the following formula:—Adurol, 10 parts; sodium sulphite, 100 parts; water, 1000 parts. Suppose that an operator wishes to convert this into grains and ounces, he would merely read 10 parts = 10

grs. ; 100 parts, 3 drs. 20 m. ; 1000 parts, 2 ozs. 40 m., which will give him the exact quantities to use.

Parts.	Grains.	Minims.	Gms.	Cubic Centimetres.
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
10	10	10	10	10
20	1 scruple.	20	20	20
50	50	50	50	50
60	1 drachm.	1 dr.	60	60
100	3 drs. 1 scr.	3 drs. 20 m.	100	100
250	½ oz. 32 grs.	½ oz. 10 m.	250	250
500	1 oz. 62 grs.	1 oz. 20 m.	500	500
1,000	2¼ ozs. 16 grs.	2 ozs. 40 m.	1,000	1,000
2,500	5½ ozs. 94 grs.	5 ozs. 1 dr. 40 m.	2,500	2,500
5,000	11¼ ozs. 79 grs.	10 ozs. 3 drs. 20 m.	5,000	5,000
10,000	1 lb. 6¾ ozs. 49 grs.	20 ozs. 6 drs. 40 m.	10,000	10,000

The ounce of solids in the above table is avoirdupois of 437.5 grains.

GRAMMES INTO GRAINS AND OUNCES (Av.)

Gm.	Grains.	Gm.	Oz.	Gr.	Gm.	Oz.	Gr.
0.1	1.5	16		246.9	130	4	256
0.2	3.1	17		262.3	140	4	410
0.3	4.6	18		277.8	150	5	127
0.4	6.2	19		293.2	160	5	280
0.5	7.7	20		308.6	170	6	0
0.6	9.1	25		385.8	175	6	76
0.7	10.8	30	1	25	180	6	153
0.8	12.4	35	1	103	190	6	307
0.9	13.9	40	1	180	200	7	24
1	15.43	45	1	257	250	8	360
2	30.9	50	1	334	300	10	250
3	46.3	55	1	411	350	12	150
4	61.7	60	2	51	400	14	50
5	77.2	65	2	128	450	15	380
6	92.6	70	2	205	500	17	280
7	108.0	75	2	282	550	19	175
8	12.35	80	2	360	600	21	70
9	138.6	85	3	0	650	22	400
10	154.3	90	3	76	700	24	300
11	169.8	95	3	153	750	26	200
12	185.2	100	3	230	800	28	95
13	200.6	110	3	384	850	29	430
14	216.1	120	4	102	900	31	325
15	231.5	125	4	179	1000	35	120

C.C S. INTO MINIMS AND OUNCES.

C.c.	Oz.	Min.	C.c.	Oz.	Min.	C.c.	Oz.	Min.
0.1		1 7	55	1	449	350	12	153
0.2		3.4	60	2	54	375	13	95
0.3		5.1	65	2	138	400	14	37
0.4		6.8	70	2	223	425	14	460
0.5		8.5	75	2	307	450	15	402
0.6		10.1	80	2	392	475	16	345
0.7		11.8	85	2	476	500	17	287
0.8		13.5	90	3	81	525	18	230
0.9		15.2	95	3	165	550	19	172
1		16.9	100	3	250	575	20	114
2		33.8	110	3	418	600	21	56
3		50.7	120	4	107	625	22	0
4		67.6	125	4	192	650	22	421
5		84.5	130	4	276	675	23	364
6		101.4	140	4	445	700	24	306
7		118.3	150	5	134	725	25	248
8		135.2	160	5	303	750	26	190
9		152	170	5	472	775	27	133
10		169	175	6	76	800	28	75
15		253	180	6	161	825	29	18
20		338	190	6	330	850	29	440
25		422	200	7	20	875	30	382
30	1	27	225	7	441	900	31	325
35	1	111	250	8	384	925	32	267
40	1	196	275	9	326	950	33	210
45	1	280	300	10	268	975	34	152
50	1	365	325	11	210	1000	35	94

GRAINS INTO GRAMMES.

Gr.	Gm.	Gr.	Gm.	Gr.	Gm.
1	.065	16	1.037	35	2.268
2	.13	17	1.102	40	2.592
3	.194	18	1.166	45	2.916
4	.259	19	1.232	50	3.240
5	.324	20	1.296	55	3.564
6	.389	21	1.361	60	3.888
7	.454	22	1.426	65	4.212
8	.518	23	1.490	70	4.536
9	.583	24	1.555	75	4.860
10	.648	25	1.620	80	5.184
11	·713	26	1.685	85	5.508
12	.775	27	1.750	90	5.832
13	.842	28	1.814	95	6.156
14	.907	29	1.880	100	6.480
15	.972	30	1.944		

OUNCES (AVOIRDUPOIS) TO GRAMMES.

Oz.	Gm.	Oz.	Gm.	Oz.	Gm.
¼	7.09	4	113.40	13	368.54
½	14.17	5	141.75	14	396.89
¾	21.26	6	170.10	15	425.24
1	28.35	7	198.45	16	453.59
1½	42.5	8	226.80	17	481.94
2	56.70	9	255.15	18	510.29
2½	70.87	11	311.8	19	538.64
3	85.05	12	340.19	20	566.99

FLUID OUNCES AND DRACHMS TO C.C.S.

Drm.	C.c.	Oz.	C.c.	Oz.	C.c.
½	1.78	1½	42.6	11	312.5
1	3.55	2	56.8	12	341.
2	7.10	3	85.2	13	369.3
3	10.65	4	113.6	14	398.
4	14.20	5	142.0	15	426.
5	17.75	6	170.5	16	454.5
6	21.30	7	198.9	17	483.
7	24.86	8	227.3	18	511.5
8	28.41	9	255.7	19	540.
		10	284.	20	568.

MILLIMETRES INTO INCHES.

Millimetres.	Inches.	Millimetres.	Inches.
0.1	0.0039	13	0.51
0.5	0.015	14	0.55
1	0.04	15	0.59
2	0.08	16	0.63
3	0.12	17	0.67
4	0.16	18	0.71
5	0.20	19	0.75
6	0.24	20	0.79
7	0.28	21	0.83
8	0.31	22	0.87
9	0.53	23	0.90
10	0.39	24	0.94
11	0.43	25	0.98
12	0.47	25.4	1.0

INCHES INTO MILLIMETRES.

Inches.		Millimetres.	Inches.		Millimetres.
In decimal fractions.	In vulgar fractions.		In decimal fractions.	In vulgar fractions.	
1.	—	25.4	0.37	$\frac{3}{8}$	9.5
0.94	$\frac{15}{16}$	23.8	0.34	$\frac{11}{32}$	8.7
0.90	$\frac{9}{10}$	23.	0.31	$\frac{5}{16}$	7.9
0.87	$\frac{7}{8}$	22.2	0.28	$\frac{9}{32}$	7.1
0.81	$\frac{13}{16}$	20.6	0.25	$\frac{1}{4}$	6.4
0.75	$\frac{3}{4}$	19.1	0.22	$\frac{7}{32}$	5.6
0.69	$\frac{11}{16}$	17.5	0.19	$\frac{3}{16}$	4.8
0.62	$\frac{5}{8}$	15.9	0.13	$\frac{1}{8}$	3.2
0.56	$\frac{9}{16}$	14.3	0.09	$\frac{3}{32}$	2.4
0.50	$\frac{1}{2}$	12.7	0.06	$\frac{1}{16}$	1.6
0.44	$\frac{7}{16}$	11.1	0.03	$\frac{1}{32}$	0.8

METRICAL SIZES CONVERTED INTO ENGLISH MEASURES.

Centimetres.	Inches.
4×4	1.57× 1.57
6×4½	2.36× 1.77
9×6½	3.54× 2.56
12×9	4.72× 3.54
18×9	7.08× 3.54
15×11	5.91× 4.33
16×12	6.30× 4.72
18×13	7.08× 5.12
20×12	7.87× 4.72
21×15	8.26× 5.91
24×18	9.44× 7.08
27×21	10.63× 8.26
30×24	11.81× 9.44
33×27	13.0 ×10.63
36×24	14.17× 9.44
40×30	15.75×11.81
48×36	18.90×14.17
50×40	19.69×15.75
60×50	23.62×19.69

ENGLISH AND METRICAL SIZES OF PLATES.

English sizes converted into Metric Measure.

Inches.	Centimetres.
$2\frac{5}{16} \times 1\frac{3}{4}$	$6. \times 4.5$
$3\frac{1}{4} \times 3\frac{1}{4}$ (lantern plate)	8.25×8.25
$4\frac{1}{4} \times 3\frac{1}{4}$ (quarter plate)	10.8×8.25
5×4	12.6×10.1
$6\frac{3}{4} \times 3\frac{1}{4}$ (stereoscopic)	17.1×8.25
$6\frac{1}{2} \times 4\frac{1}{4}$	16.5×10.8
$6\frac{1}{2} \times 4\frac{3}{4}$ (half plate)	$16.5 \times 12.$
7×5	17.8×12.7
$7\frac{1}{2} \times 5$	19.0×12.7
8×5	20.3×12.7
$8\frac{1}{2} \times 6\frac{1}{2}$ (whole plate)	21.5×16.5
10×8	25.4×20.3
12×10	30.4×25.4
15×12	38.1×30.4
18×16	45.6×40.5
20×16	50.8×40.5
22×18	55.9×45.6
24×20	61.0×50.8
30×24	76.2×61.0

DIAPHRAGMS STANDARDS.

The present recommendations of the Royal Photographic Society are as follows:—

Lens Diaphragms.

1. That intensity ratio be defined as dependent upon the *effective aperture*, and not upon the diameter of the diaphragm, in relation to the focal length of the lens

2. That effective aperture be determined in the following manner: The lens shall be focussed for parallel rays; an opaque screen shall be placed in the principal focal plane, the plate being provided in its centre (in the axis of the lens) with a pin-hole; an illuminant shall be placed immediately behind the pin-hole, and the diameter of the beam of light emerging from the front surface of the lens shall be the measure of the effective aperture.

Note.—It will be found, except when the diaphragm is situated in front of the lens, that the diameter of the diaphragm itself is seldom identical with the effective aperture.

3. That every diaphragm be marked with its true intensity ratio, as above defined, in the following order of sequence: $f/1$, $f/1.4..$, $f/2$, $f/2.8..$, $f/4$, $f/5.6..$, $f/8$, $f/11.3..$, $f/16$, $f/22.6..$, $f/32$, $f/45.2..$, $f/64$, etc., each diaphragm requiring double the exposure required by the preceding diaphragm.

Should the greatest effective aperture of a lens not conform exactly to one of the intensities set forth above, this aperture should be marked in accordance with the definition of effective aperture, but all succeeding smaller apertures should be marked in uniformity with the intensities recommended in the above sequence.

The recommendations of the Society as to standard lens, mounts, and fittings will be found in the "British Journal Almanac" for 1905 and previous years.

A TABLE OF ATOMIC WEIGHTS OF THE CHEMICAL ELEMENTS.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Aluminium	Al	27	27 1
Antimony	Sb	120	120·2
Argon	A	40	39·9
Arsenic	As	75	75·0
Barium	Ba	137	137·43
Beryllium	Be=Gl	9·1	9·1
Bismuth	Bi	208	208 0
Boron	B	11	11·00
Bromine	Br	80	79·96
Cadmium	Cd	112	112·4
Cæsium	Cs	133	132·9
Calcium	Ca	40	40·1
Carbon	C	12	12·0
Cerium	Ce	140	140·25
Chlorine	Cl	35 5	35·451
Chromium	Cr	52	52 11
Cobalt	Co	59	59·00
Copper	Cu	63·5	63·60
Erbium	Er	166	166·0
Fluorine	F	19	19·0
Gadolinium	Gd	156	156·01
Gallium	Ga	70	70·0
Germanium	Ge	72·5	72·5
Gold	Au	197	197·2
Helium	He	4	4·0
Hydrogen	H	1	1·008
Indium	In	115	115·0
Iodine	I	127	126·97
Iridium	Ir	193	193·0
Iron	Fe	56	55·9
Lanthanum	La	139	138·9
Lead	Pb	207	206·92
Lithium	Li	7	7·03
Magnesium	Mg	24	24·36
Manganese	Mn	55	55·0
Mercury	Hg	200	200 0

A TABLE OF ATOMIC WEIGHTS—CONTINUED.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Molybdenum	Mo	96	96·0
Neodymium	Nd	144	143·6
Nickel	Ni	59	58·70
Niobium	Nb=Cb	94	94·0
Nitrogen	N	14	14·04
Osmium	Os	191	191·0
Oxygen (Standard)	O	16	16·0
Palladium	Pd	106	106·5
Phosphorus	P	31	31·0
Platinum	Pt	193·4	194·8
Potassium	K	39	39·15
Praseodymium	Pr	141	140·5
Rhodium	Rh	103	103·0
Rubidium	Rb	85	85·5
Ruthenium	Ru	102	101·7
Samarium	Sm	150	150·3
Scandium	Sc	44	44·1
Selenium	Se	79	79·2
Silicon	Si	28	28·4
Silver	Ag	108	107·93
Sodium	Na	23	23·05
Strontium	Sr	87·5	87·6
Sulphur	S	32	32·06
Tantalum	Ta	183	183·0
Tellurium	Te	128	127·6
Terbium	Tb	160	160·0
Thallium	Tl	204	204·1
Thorium	Th	233	232·5
Thulium	Tu	171	171·0
Tin	Sn	118	119·0
Titanium	Ti	48	48·1
Tungsten	W	184	184·0
Uranium	U	240	238·5
Vanadium	V	51	51·4
Ytterbium	Yb	173	173·0
Yttrium	Yt	89	89·0
Zinc	Zn	65	65·4
Zirconium	Zr	91	90·6

TABLE OF SYMBOLS AND EQUIVALENT WEIGHTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

The atomic weights of the elements employed in working out the equivalent weights given below are the round numbers contained in the first column of the Table of Atomic Weights on page .

NAME.	SYMBOL.	EQUIV. WEIGHT.
Acetone	$C_3 H_6 O$	58
,, Sulphite	$C_3 H_6 OH SO_3 Na$	162
Acid, Acetic	$C_2 H_4 O_2$	60
,, Benzoic	$C_6 H_5 COOH$	122
,, Boric	$H_3 BO_3$	62
,, Carbolic	$C_6 H_5 OH$	94
,, Chromic (Anhydride)	CrO_3	100
,, Citric	$C_6 H_8 O_7 H_2O$	210
,, Formic	$H_2 CO_2$	46
,, Gallic	$C_6 H_2 (OH)_3 COOH. H_2 O$	188
,, Hydrobromic	$H Br$	81
,, Hydrochloric	$H Cl$	36·5
,, Hydrofluoric	$H F$	34
,, Lactic	$CH_3 CH (OH) COOH$	90
,, Nitric	HNO_3	63
,, Oxalic	$H_2 C_2 O_4$	126
,, Phosphoric	$H_3 PO_4$	98
,, Picric	$C_6 H_2 (NO_2)_3 OH$	139
,, Pyrogallic	$C_6 H_3 (OH)_3$	126
,, Salicylic	$C_6 H_4 (OH) COOH$	138
,, Sulphuric	$H_2 SO_4$	98
,, Sulphurous	$H_2 SO_3$	82
,, Tannic	$C_{14} H_{10} O_9$	322
,, Tartaric	$C_2 H_2 (OH)_2 (COOH)_2$	150
Adurol*	$C_6 H_3 (OH)_2 Cl$ (or Br)	—
Alcohol (Methyl)	$CH_3 OH$	32
,, (Ethyl)	$C_2 H_5 OH$	46
Alum, Ammonia	$Al_2 (NH_4)_2 (SO_4)_4 24H_2O$	906
,, Chrome	$Cr_2 K_2 (SO_4)_4 24H_2O$	998
,, Iron Ammonia	$Fe_2 (NH_4)_2 (SO_4)_4 24H_2O$	964
,, Potash	$Al_2 K_2 (SO_4)_4 24H_2O$	948
Aluminium, Chloride	$Al_2 Cl_6 12H_2O$	267
,, Sulphate	$Al_2 (SO_4)_3 16H_2O$	634
,, Sulphocyanide	$Al_2 (CNS)_6$	402
Amidol	$C_6 H_3 OH NH_2 HCl$	144·5
Ammonia	NH_3	17
Ammonium, Bichromate	$(NH_4)_2 Cr_2 O_7$	252
,, Bromide	$NH_4 Br$	98
,, Carbonate	$NH_4 HCO_3 + NH_2 COOH NH_4$	—
,, Chloride	$NH_4 Cl$	53·5
,, Citrate	$(NH_4)_2 C_6 H_6 O_7$	226

* Adurol is mono-chlor (or mono-brom) hydroquinone.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Ammonium, Iodide	$NH_4\ I$	145
" Molybdate	$(NH_4)_6\ Mo_7\ O_{24}\ 4H_2O$	1236
" Nitrate	$NH_4\ NO_3$	80
" Oxalate	$(NH_4)_2\ C_2O_4\ H_2O$	142
" Persulphate	$(NH_4)_2\ S_2\ O_8$	228
" Sulphide	$NH_4\ S$	50
" Sulphocyanide	$NH_4\ CNS$	76
" Vanadate	$NH_4\ VO_3$	117
Amyl, Acetate	$C_7\ H_{14}\ O_2$	130
" Alcohol	$(CH_3)_2\ CH\ CH_2\ CH_2OH$	88
Aniline	$C_6\ H_5\ NH_2$	93
'Anthion" (Potass. persulphate)		
'Antimony, Sulphide	$Sb_2\ S_3$	336
Aurantia	$(C_6H_2(NO_2)_3)_2\ N\ NH_4$	456
Aurine	$C\ (C_6\ H_4\ OH)_2\ C_6\ H_4\ O$	290
Barium, Bromide	$Ba\ Br_2\ 2H_2O$	333
" Chloride	$Ba\ Cl_2\ 2H_2O$	244
" Iodide	$Ba\ I_2$	391
" Nitrate	$Ba\ (NO_3)_2$	261
" Peroxide	BaO_2	201
" Sulphate	$Ba\ SO_4$	233
Benzole (Benzene)	$C_6\ H_6$	78
Borax (*see* Sodium Borate)		
Bromine	Br	80
Cadmium, Bromide	$Cd\ Br_2\ 4H_2O$	344
" Chloride	$Cd\ Cl_2$	183
" Iodide	$Cd\ I_2$	366
Calcuim, Carbide	$Ca_2\ C$	92
" Carbonate	$Ca\ CO_3$	100
" Chloride (Cryst.)	$Ca\ Cl_2\ 6H_2O$	219
" " (Fused)	$Ca\ Cl_2$	111
" Hypochlorite	$Ca\ (O\ Cl)_2$	153
" Sulphate	$Ca\ SO_4\ 2H_2O$	172
" Hydoxide (Slaked Lime)	$Ca\ (OH)_2$	74
Carbon, Bisulphide	$C\ S_2$	76
Celloidin	$C_{12}\ H_{16}\ O_6\ (NO_3)_4$	504
Ceric, Sulphate	$Ce\ (SO_4)_2\ 4H_2O$	404
Chloral, Hydrate	$C\ Cl_3\ CH\ (OH)_2$	165·5
Chloroform	$CH\ Cl_3$	119·5
Chrysoidine	$C_6\ H_5\ N_2\ C_6\ H_3\ (NH_2)_2$	211·7
Cobalt, Chloride	$Co\ Cl_2\ 6H_2O$	238
Copper, Bromide	$Cu\ Br_2$	223·5
" Chloride	$Cu\ Cl_2\ 2H_2O$	170·5
" Sulphate	$Cu\ SO_4\ 5H_2O$	249·5
Cyanine	$C_{29}\ H_{35}\ N_2\ I$	544
Dextrine	$(C_6\ H_{10}\ O_5)\ x$	—
Diamido, Phenol	$C_6\ H_3\ OH\ (NH_2)_2$	124

TABLE OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Edinol*		
Eikonogen†	$C_{10} H_5 (OH) NH_2 SO_2 O Na$	263
Eosine	Na or K Salt of	—
	$C_6 H_4 (CO)_2 O (C_6 H OH X‡)_2$	—
Erythrosine	$C_6 H_4 (CO)_2 O (C_6 H OH X_2‡)_2$	—
Ether	$C_4 H_{10} O$	74
Ferrous and ferric salts (See Iron)		
Formaline	40% sol. of CH_2O	—
Glycerine	$C_3 H_5 (OH)_3$	92
Glycine*	$C_6 H_4 OH NHCH_2 COOH$	167
Gold, chloride yellow	$H Au Cl_4 4H_2O$	412
„ „ brown	$H Au Cl_4$	340
„ „ potassium	$K Au Cl_4 2H_2O$	414
„ „ sodium	$Na Au Cl_4 2H_2O$	398
Hydrogen, peroxide	H_2O_2	34
Hydroquinone	$C_6 H_4 (OH)_2$	110
Iodine	I	127
Iridious chloride	$Ir Cl_3$	299·5
„ tetrachloride	$Ir Cl_4$	335
„ potassium „	$K_2 Ir Cl_6$	484
„ sodium „	$Na_2 Ir Cl_6$	452
IRON.		
Ferric chloride (dry)	$Fe_2 Cl_6$	325
„ „ (lump)	$Fe_2 Cl_6 12H_2O$	541
„ ammonia citrate, brown	$4 Fe C_6 H_5 O_7 3 (NH_4)_3 C_6H_5O_7 3 Fe (OH)_3$	—
„ „ „ green	$5 Fe C_6H_5O_7 2(NH_4)_3 C_6H_5O_7 NH_4 C_6H_7O_7 2H_2O$	—
„ oxalate	$Fe_2 (C_2 O_4)_3$	376
„ ammonium oxalate	$(NH_4)_3 Fe (C_2 O_4)_3 3H_2O$	428
„ potassium „	$K_3 Fe (C_2 O_4)_3 3H_2O$	491
„ sodium „	$Na_6 Fe (C_2O_4)_6 11H_2O$	976
Ferrous, chloride (dry)	$Fe Cl_2$	127
„ „ (cryst.)	$Fe Cl_2 4H_2O$	199
„ oxalate	$Fe C_2 O_4 2H_2O$	180
„ potassium oxalate	$K_2 Fe (C_2 O_4)_2 H_2O$	328
„ sulphate	$Fe SO_4 7H_2O$	278
„ ammonia sulphate	$Fe (NH_4)_2 (SO_4)_2 6H_2O$	392
Lead, acetate	$Pb (C_2 H_3 O_2)_2 3H_2O$	379
„ nitrate	$Pb (NO_3)_2$	331
Lithia, caustic	Li OH	24
Lithium, bromide	Li Br	87
„ carbonate	$Li_2 CO_3$	74

* Edinol is the hydrochloride of γ-amido-oxy-benzyl-alcohol.
† Eikonogen is the sodium salt of amido-β-naphthol-β-monosulphuric acid.
‡ The X in these formulæ may be bromine, iodine, or chlorine, which elements in other proportions constitute the various commercial dyes.
§ Glycine is γ-oxyphenyl-glycin or γ-oxyphenyl amido-acetic acid.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Lithium, chloride	$Li\,Cl$ (Cryst has $2H_2O$)	42.5
,, iodide	$Li\,I$	134
Magnesium, chloride	$Mg\,Cl_2$	95
,, sulphate	$Mg\,SO_4\,7H_2O$	246
Maganese, peroxide	$Mn\,O_2$	87
,, sulphate	$Mn\,SO_4\,4H_2O$	225
Mercury	Hg	200
,, bichloride	$Hg\,Cl_2$	271
,, iodide	$Hg\,I_2$	454
Metol*	$(C_6\,H_4\,OH\,NHCH_3p)_2\,H_2\,SO_4$	344
Ortol†	$(C_6\,H_4\,OH\,NHCH_3p) + C_6\,H_4\,(OH)_2p$	234
Palladious chloride	$Pd\,Cl_2$	177
,, potassium chloride	$K_2\,Pd\,Cl_4$	326
Para-amidophenol	$C_6\,H_4\,NH_2\,OH$	109
Phenol (see Acid carbolic)		
Platinum per(or bi)chloride	$H_2\,Pt\,Cl_6\,6H_2O$	516·4
Potassium, ammonium chromate	$K\,NH_4\,Cr\,O_4$	173
,, bicarbonate	$K\,H\,CO_3$	100
,, bichromate	$K_2\,Cr_2\,O_7$	294
,, boro-tartrate	$C_2\,H_2\,(OH)_2\,(CO_2)_2\,BOK$	214
,, bromide	$K\,Br$	119
,, carbonate (dry)	$K_2\,CO_3$	138
,, chlorate	$K\,Cl\,O_3$	122·5
,, chloride	$K\,Cl$	74·5
,, chloro-platinite	$K_2\,Pt\,Cl_4$	413·4
,, chromate	$K_2\,Cr\,O_4$	194
,, citrate	$K_3\,C_6\,H_5\,O_7\,H_2O$	342
,, cyanide	$K\,C\,N$	65
,, ferricyanide	$K_6\,Fe\,(CN)_6$	329
,, ferrocyanide	$K_4\,Fe\,(CN)_6\,3H_2O$	422
,, hydrate	$K\,HO$	56
,, iodide	$K\,I$	166
,, metabisulphite	$K_2\,S_2\,O_5$	222
,, nitrate	$K\,NO_3$	101
,, nitrate	$K\,NO_2$	85
,, oxalate	$K_2\,C_2\,O_4\,H_2O$	184
,, percarbonate	$K_2\,C_2\,O_6$	198
,, perchlorate	$K\,Cl\,O_4$	138.5
,, permanganate	$K_2\,Mn_2\,O_8$	316
,, persulphate	$K_2\,S_2\,O_8$	270
,, sulphocyanide	$K\,C\,N\,S$	97
Pyrocatechine	$C_6\,H_4\,(OH)_2$	110
Rochelle salt	$K\,Na\,C_4\,H_4\,O_6\,4H_2O$	282

* Metol is the sulphate of mono-methyl-para amido-phenol.
† Ortol is a mixture of one molecule each of methyl-ortho-amido-phenol and hydroquinone.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Schlippe's salt	$Na_3\ Sb\ S_4\ 9H_2O$	479
Silver, acetate	$Ag\ C_2\ H_3\ O_2$	167
„ ammonium nitrate	$Ag\ NO_3+2NH_3$	204
„ bromide	$Ag\ Br$	188
„ carbonate	$Ag_2\ CO_3$	276
„ chloride	$Ag\ Cl$	143·5
„ citrate	$Ag\ C_6\ H_5\ O_7$	513
„ fluoride	$Ag\ F\ 4H_2O$	199
„ iodide	$Ag\ I$	235
„ nitrate	$Ag\ NO_3$	170
„ nitrite	$Ag\ NO_2$	154
„ oxalate	$Ag_2\ C_2\ O_4$	304
„ oxide	$Ag_2\ O$	224
„ phosphate	$Ag_3\ PO_4$	419
„ sulphate	$Ag_2\ SO_4$	312
„ sulphide	$Ag_2\ S$	248
„ tartrate	$Ag_2\ C_4\ H_4\ O_6$	363·4
Sodium, acetate	$Na\ C_2\ H_3\ O_2\ 3H_2O$	136
„ bicarbonate	$Na\ H\ CO_3$	84
„ bichromate	$Na_2\ Cr_2\ O_7\ 2H_2O$	298
„ bisulphite	$Na\ H\ SO_3$	104
„ borate	$Na_2\ B_4\ O_7\ 10H_2O$	382
„ bromide	$Na\ Br\ 2H_2O$	139
„ carbonate (dry)	$Na_2\ CO_3$	106
„ carbonate (cryst.)	$Na_2\ CO_3\ 10H_2O$	286
„ chloride	$Na\ Cl$	58·5
„ chloro-platinate	$Na_2\ Pt\ Cl_6\ 6H_2O$	560·4
„ citrate	$Na_3\ C_6\ H_5\ O_7\ 5\frac{1}{2}H_2O$	357
„ fluoride	$Na\ F$	42
„ hydrate (caustic)	$Na\ OH$	40
„ hydrosulphite*	$Na\ H\ SO_2$	88
„ hyposulphite*	$Na_2\ S_2\ O_3\ 5H_2O$	248
„ iodide	$Na\ I$	150
„ nitrate	$Na\ NO_3$	85
„ nitro-prusside	$Na_4\ Fe_2\ (C\ N)_{10}\ (NO)_2\ 4H_2O$	600
„ oxalate	$Na_2\ C_2\ O_4$	134
„ phosphate	$Na_2\ HPO_4\ 12H_2O$	358
„ tribasic phosphate	$Na_3\ PO_4\ 12H_2O$	380
„ sulphide	$Na_2\ S\ 9H_2O$	240
„ sulphite (dry)	$Na_2\ SO_3$	126
„ „ (cryst.)	$Na_2\ SO_3\ 7H_2O$	252
„ tungstate	$Na_{10}\ W_{12}\ O_{41}\ 28H_2O$	3798
Strontium, bromide	$Sr\ Br_2$	247·5
„ chloride (dry)	$Sr\ Cl_2$	158·5
„ „ (cryst.)	$Sr\ Cl_2\ 2H_2O$	194·5

* Called "hyposulphite" by chemists. * Called "thiosulphate" by chemists.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Strontium, iodide	$Sr\ I_2$	341·5
,, nitrate	$Sr\ (NO_3)_2$	211·5
Thiocarbamide	$CS\ (NH_2)_2$	76
Thiosinamine	$CS\ (NH_2)\ NH\ C_3\ H_5$	116
Thymol	$CH_3\ C_6\ H_3\ OHC_3\ H_7$	150
Tin (Stannous) chloride	$Sn\ Cl_2 + 2H_2O$	225
Uranium, acetate	$UO_2\ (C_2\ H_3\ O_2)_2\ 2H_2O$	426
,, chloride	$UO_2\ Cl_2$	343
,, nitrate	$UO_2\ (NO_3)_2\ 6H_2O$	504
Zinc, sulphate	$Zn\ SO_4\ 7H_2O$	287

TABLE OF THE SOLUBILITIES OF THE PRINCIPAL SUBSTANCES USED IN PHOTOGRAPHY.

sol.=soluble; v.s.=very soluble; s.s.=slightly soluble; dec.=decompose insol.=insoluble.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Acetone	...	...	...	
,, sulphite	v.s.	...	...	s.s.
Acid, acetic	...	...	...	
,, benzoic	380	45	·27	1 in 2·75 90 %
,, boric	29	2·9	3½	1 in 28 90 %
,, carbolic	15		6·6	v.s.
,, chromic (anhydride)	·6	v.s.	160	sol. with decomp.
,, citric	¾	½	130	
,, formic	...	...	...	
,, gallic	100	·3	1	1 in 5 90% alcohol 1 in 40 ether.
,, hydriodic	...	...	...	
,, hydrobromic	...	...	...	
,, hydrocyanic	...	...	...	
,, hydrochloric	...	...	...	
,, hydrofluoric	...	...	...	
,, lactic	...	...	...	

Acetone.—(Sp. gr. ·814). boils at 133°F. miscible in all proportions with water, alcohol, and ether. A solvent of resin, fats, camphor, pyroxylin and celluloid.

Acetic Acid.—The "glacial" acid, which is that implied in formulæ unless a weaker acid is directed, solidifies about 50°. Its sp. gr. is 1·055; it boils at 245°F. It is a solvent of gelatine, celluloid, pyroxyline, fats, oils, etc., blisters the skin, strongly absorbs water from the air, and is miscible with water, alcohol, ether, chloroform, and glycerine in all proportions.

Formic Acid.—A colourless liquid of 1·22 sp. gr. (=100% acid), miscible with water and alcohol. Weaker solutions are:—1·20 (90%) : 1·18 (80%) : 1·15 (65%) : 1·12 (50%) and 1·06 (25%).

Hydriodic Acid.—A solution of the gas, HI., and obtainable as strong as sp. gr. 2·0 (=96% HI). Solution of sp. gr. 1.7 contains about 52%; sp. gr. 1.5, about, 43%.

Hydrobromic Acid.—A solution of the gas, HBr., in water. The strongest solution has sp. gr. of 1·78 (=82%) sol. of 1·495 sp. gr. contains 48% HBr.; 1·38, 40% : 1·208, 25%.

Hydrochloric Acid.—A solution of the gas, HCl, in water. The commercial strongest acid has sp. gr. 1·21, and contains about 40% HCl. Impure acid is sold as "spirits of salts."

Hydrocyanic Acid (=Prussic acid).—The strength of the official acid of the British Pharmacopœia is 2% A 10% acid is obtainable in the chemical trade. Both are the most deadly and dangerous poisons.

Hydrofluoric acid is a strongly fuming solution of the gas, HF.; it is sold of strengths, 40% and 55% HF.

Lactic acid is sold as a colourless syrupy liquid, miscible with water or alcohol, Sp. gr. 1·21. A weaker acid is also sold commercially containing 50% acid

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in—parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Acid nitric	...	...	...	
" oxalic	9·5	·3	$10\frac{1}{2}$	
" phosphoric	...	...	...	
" picric	100	...	1	1 in 10 90% also in ether.
" pyrogallic	$2\frac{1}{4}$	v.s.	44	sol. also in ether, not in chloroform.
" salicylic	500	$12\frac{1}{2}$	$\frac{1}{5}$	1 in 3·5, 1 in 2 in ether.
" sulphuric	...	...	...	
" sulphurous	...	...	...	
" tannic	·5	...	20	1 in ·6, nearly insol. in ether.
" tartaric	$\frac{3}{4}$	$\frac{1}{3}$	132	
Adurol	...	...	...	
Agar-agar	...	...	...	
Albumen	...	...	...	
Alcohol ethyl	...	...	...	
" methyl	...	...	...	
Alum, ammonia	8·3	·24	12	insoluble
" chrome	6	dec.	16	
" iron ammonia	3	dec.	33	insoluble
" potash	8	·28	13	insoluble
Aluminium, chloride	$\frac{1}{4}$	v.s.	400	soluble
" sulphate	1	·09	100	

Nitric Acid.—Strongly corrosive liquid of 1·42 sp. gr. (=71% HNO_3); soluble in water; oxidizes alcohol and other organic solvents.

Phosphoric Acid.—Sold as a syrupy liquid, that of 1·75 sp. gr. (=about 90% acid), being intended when "phosphoric acid" is prescribed in formulæ.

Sulphuric Acid.—The commercial strong acid is a thick corrosive liquid of 1·84 sp. gr. (=98% H_2SO_4). It absorbs water rapidly from the air, and, mixed with water, great heat is developed. The acid should always be added to water—not *vice versâ.*

Sulphurous Acid.—Solution in water of the gas SO_2; saturated solution of 1·046 is equivalent to 9·5% H_2SO_3, but soon loses strength.

Albumen.—On heating the cold solution to 160° F. the albumen separates in insoluble form. Alcohol similarly coagulates albumen.

Methyl Alcohol (sp. gr. ·814).—The chief constituent of crude "wood spirit," or wood naphtha, in which is usually 10% of acetone.

Ethyl Alcohol forms "absolute alcohol" (sp. gr. ·830 to ·834), which contains from 2 to 5% water. Alcohol containing 16% water is "rectified spirit." "Methylated" spirit consists of rectified spirit *plus* 10 % crude wood spirit and $\frac{1}{8}$% mineral naphtha, the latter precipitating as a milkiness on addition of water. These various forms of alcohol mix with water, which can be abstracted with dry potassium carbonate.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Aluminium, sulphocyanide	...	...	...	
Amidol	4	v.s.	24	less sol. in alc. & eth.
Ammonium, bichromate	10	¼	10	1 in 31 absolute alc.
,, bromide	1·4	v.s.	72	
,, carbonate	4	dec.	25	
,, chloride	3	1·4	35	
,, citrate	½	v.s.	200	
,, iodide	·6	v.s.	165	1 in 4 alc., s.s. in ether
,, molybdate	2½	dec.	40	
,, nitrate	½	v.s.	200	
,, oxalate	23	2·4	4·3	sol.
,, persulphate	1½	dec.	65	
,, (hydro) sulphide	...	...	...	
,, sulphocyanide	·6	v.s.	160	v.s.
,, vanadate	s.s.	v.s.	...	
Amyl, acetate	...	...	...	
,, alcohol	...	...	...	
Aniline	...	...	...	
Antimony sulphide	insol.	...	...	
Aurantia	s.s.	...	...	v.s.; s.s. in ether
Aurine	s.s.	...	...	sol.; also in ether
Barium bromide	·75	·5	133	v.s. in benzine
,, chloride	2·4	1·3	42	insol.
,, iodide	½	v.s.	200	1 in 20 alcohol.
,, nitrate	12	3·1	8	insol.
Bromine	31	...	3·2	
Cadmium, bromide	·94	v.s.	106	1 in 3 alc; 1 in 250 eth
,, chloride	·71	·67	140	1 in 8 alcohol
,, iodide	1·08	·75	93	1 in 1 alc.; 1 in 3-6 eth
Calcium, chloride (cryst.)	¼	v.s.	400	
,, ,, (fused)	1·4	·65	70	
,, sulphate	380	450	·3	
,, hydroxide	700	1,300	·137	
Ceric sulphate	12	200	8·3	
Chloral hydrate	¼	...	400	1 in 1/5 90% 1 in 50 carbon bisulphide

Aluminium Sulphocyanide is purchased as a reddish solution of 1·16 sp. gr.

Ammonium Sulphide is sold as a deep yellow solution containing also poly-Sulphides.

Amyl Acetate.—Liquid of sp. gr. ·876, miscible with alcohol and ether, but not with water. A solvent of fats, oils, resins, pyroxyine and celluloid.

Amyl Alcohol, the chief constituent of fusel oil, is not miscible with water.

Aniline (sp. gr. 1·036) is freely miscible with alcohol or ether, but only very slightly with water. It boils at 356° F. and coagulates albumen.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Copper, bromide	v.s.	v.s.	...	
„ chloride	·83	v.s.	121	v.s.; also in ether.
„ sulphate	2½	½	40	
Cyanine	s.s.	...	...	
Diamidophenol	sol.	...	...	
Edinol	sol.	...	...	[or ether.
Eikonogen	25	...	4·2	nearly insol. in alchl.
Eosine	sol.	...	...	insol. in ether
Ether	12	...	8	
Erythrosine	s.s.	...	...	s.s.
Glycerine	...	...	...	
Glycine	...	...	...	
Gold, chloride	v.s.	v.s.	...	
Hydroquinone	17	...	6	
Iodine	insol.	insol.	...	sol.; also in carbon bi-sulphide
Iron				
Ferric chloride (lump)	v.s.	v.s.	...	
„ „ (dry)	·63	v.s.	160	
„ ammonium citrate	4	...	25	
(brown)*	...	...	...	
„ „ (green)†	...	...	...	
„ oxalate	...	...	...	
„ ammonium oxalate	2·1	...	·48	
„ potassium „	15	·85	6·6	insol.
„ sodium „	1·69	0·55	60	
Ferrous chloride (dry)	2	v.s.	50	
„ „ (cryst.)	·68	v.s.	147	
„ oxalate	4500	3800	...	
„ potass. oxalate	...	...	...	
„ sulphate	1·43	0·27	70	
„ am. sulphate	3	...	33	
Lead, acetate	1½	0·5	66	1 in 15 alcohol insol. in ether

Ether (called also "sulphuric ether") is very volatile and inflammable. Boils at 95° F. sp. gr. ·722.

Formaline.—A commercial strong solution (40%) of formic aldehyde, CH_2O.

Gelatine becomes swollen in cold water and dissolves in hot. Dissolves in the cold by oxalic, acetic, hydrochloric, and nitric acids, barium chloride and chloral, hydrate. Precipitated from its solution in water by alcohol.

Glycerine.—Miscible with water or alcohol. Sp. gr. 1·265.

Iodine dissolves freely also in carbon bisulphide or potassium iodide solution

Ferric Oxalate is very soluble, over 20%, it is partially reduced to ferrous oxalate on heating the solution to 212°F.

Seven parts of ferrous sulphate correspond with 10 parts ferrous ammonium sulphate.

* 21·7–22·4% iron. † 14 to 15% iron.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water. Cold	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Lead, nitrate	2	·7	50	
Lithia, caustic	s.s.			
Lithium, bromide	·7	·4	143	v.s.
„ carbonate	72	138	1·3	
„ chloride	$1\frac{1}{4}$	·8	80	v.s.
„ iodide	·61	·2	164	v.s.
Magnesium, chloride (dry)	1·7	$1\frac{1}{2}$	60	
„ sulphate	1	·15	100	
Manganese, sulphate	·8	1	120	insol. in absolute alc.
Mercury, bichloride	16	1·8	6·3	1 in 4·90 %
„ iodide	150	...	·66	
Metol	sol.	...	...	s.s.; also in ether.
Ortol	sol.	...	...	
Para-amido-phenol	10	...	10	1 in 22
Phenol (*see* acid carbolic)				
Potassium, bicarbonate	4	dec.	25	
„ bichromate	10	1	10	
„ borotartrate	$\frac{3}{4}$	v.s.	135	
„ bromide	$1\frac{1}{2}$	1	65	1 in 750
„ carbonate (dry)	·9	·64	112	insol.
„ chlorate	17	2	6	insol.
„ chloride	3	1·75	33	
„ chloroplatinite	6	v.s.	17	insol.
„ chromate	2	1·2	50	insol.
„ citrate	·6	v.s.	166	v.s.
„ cyanide	·8	v.s.	122	1 in 9
„ ferricyanide	$2\frac{1}{2}$	1.3	40	
„ ferrocyanide	3·4	2	29	insol.: insol. in eth.
„ hydrate	$\frac{1}{2}$	v.s.	200	sol.
„ iodide	·7	$\frac{1}{2}$	140	1 in 16·90 %
„ metabisulphite	sol.	dec.	...	
„ nitrate	$3\frac{1}{2}$	·4	28	
„ nitrite	1	v.s.	100	insol.
„ oxalate	3	v.s.	33	
„ percarbonate	15	dec.	6·5	
„ perchlorate	100	5	1	
„ permanganate	16	...	6·25	
„ persulphate	50	dec.	2	insol. in absolute alc.
„ sulphocyanide	·46	v.s.	220	
Pyrocatechin	$1\frac{1}{4}$	v.s.	80	
Rochelle salt	$1\frac{1}{2}$	v.s.	66	
Schlippe's salt	3	v.s.	33	

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 parts water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Silver, acetate	100	...	1	
" carbonate	insol.	...	...	
" chlorate	5	2	20	
" citrate [1]	insol.	...	...	
" cyanide	insol.	...	...	
" fluoride [2]	v.s.	v.s.	...	
" nitrate	·44	·1	227	1 in 26, 90%
" nitrite	s.s.	...	...	
" sulphate	87	...	1·15	
" sulphocyanide	insol.	...	...	
" tartrate	insol.	...	...	
Sodium, acetate	2·8	v.s.	36	1 in 50, 90%: insol. in ether
" bicarbonate	11·3	dec.	8·8	
" bichromate	1	·6	100	
" bisulphite	v.s.	...	...	
" borate	12½	½	8	
" bromide	1·1	·9	90	1 in 15
" carbonate (dry)	6	2·2	16·2	
" " (cryst.)	1·56	v.s.	6·3	
" chloride	3	2½	35	
" chloroplatinate	sol.	...	...	
" citrate	sol.	...	...	s.s.
" fluoride	25	...	4	
" hydrate (caustic)	v.s.	v.s.	...	
" hyposulphite	·6	v.s.	170	insol.
" iodide	·6	·4	166	
" nitrate	1·1	·6	85	
" oxalate	35	...	3	
" phosphate	6·7	1	15	
" sulphide	v.s.	v.s.	...	
" sulphite (cryst.)	2·2	1	45	
" " (dry)	4	...	25	
" tri-basic phosphate	·5	v.s.	20	
" tungstate	8 to 12	...	...	insol.
" (meta) vanadate	½	v.s.	200	
Strontium, bromide	1·01	½	100	1 in 30, 90%
" chloride	1·96	1	51	
" " (cryst.)	1·33	·6	75	
" iodide	·56	·25	18	
" nitrate	1·41	1	71	
Thiocarbamide	11	v.s.	9	v.s. also in ether

1. Readily soluble in ammonia and in hypo.
2. $AgF4H_2O$ is almost as soluble as calcium chloride.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Thiosinamine	17	...	6	1 in 2 90% : als. in eth.
Thymol	330		·3	1 in ·375 90% : al. in et.
Tin (stannous), chloride ...	$1\frac{1}{2}$	v. s.	66	
Uranium, acetate	v. s.	v. s	...	
,, chloride	v. s.	v. s.	...	
,, nitrate	$\frac{1}{2}$	v. s.	200	
Zinc, sulphate	·62	·15	161	

PERCENTAGE OF REAL AMMONIA IN SOLUTIONS OF DIFFERENT DENSITIES AT 14° CENTIGRADE.—Carius.

Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.
0·8844	36·0	0·9052	27·0	0·9314	18·0	0·9631	9·0
0·8864	35·0	0·9078	26·0	0·9347	17·0	0·9670	8·0
0·8885	34·0	0·9106	25·0	0·9380	16·0	0·9709	7·0
0·8907	33·0	0·9133	24·0	0·9414	15·0	0·9749	6·0
0·8929	32·0	0·9162	23·0	0·9449	14·0	0·9790	5·0
0·8953	31·0	0·9191	22·0	0·9484	13·0	0·9831	4·0
0·8976	30·0	0·9221	21·0	0·9520	12·0	0·9873	3·0
0·9001	29·0	0·9251	20·0	0·9556	11·0	0·9915	2·0
0·9026	28·0	0·9283	19·0	0·9593	10·0	0·9959	1·0

SOLUBILITY OF THE SILVER HALOIDS.

By E. VALENTA.

Solvent.	Concentration.	100 g. of solution can dissolve in grammes.			Remarks.
		Ag Cl.	Ag Br.	Ag I.	
Sodium hyposulphite	1 : 100	0·40	0·35	0·03	The estimations were made at 70° F.
,,	5 : 100	2·00	1·90	0·15	
,,	10 : 100	4·10	3·50	0·30	
,,	15 : 100	5·50	4·20	0·40	
,,	20 : 100	6·10	5·80	0·60	
Ammonium hyposulphite	1 : 100	0·57	—	—	For bromide and iodide of silver similar results were obtained as with sodium hyposulphite.
,,	5 : 100	1·32	—	—	
,,	10 : 100	3·92	—	—	
Sodium sulphite	10 : 100	0·44	0·04	0·01	
,,	20 : 100	0·95	0·08	0·02	
Ammonium sulphite	10 : 100		traces		
Ammonium carbonate	10 : 100	0·05	—	—	
Ammonia	3%	1·40	—	—	
,,	15%	7·58	—	—	
Magnesium chloride	50 : 100	0·50	—	—	
Potassium cyanide	5 : 100	2·75	6·55	8·23	80° F.
Ammonium sulphocyanide	5 : 100	0·08	0·21	0·02	76° F.
,,	10 : 100	0·54	2·04	0·08	
,,	15 : 100	2·88	5·30	0·13	
Potassium sulphocyanide	10 : 100	0 11	0·73	—	80° F.
Calcium sulphocyanide	10 : 100	0·15	0·53	0.03	
Barium sulphocyanide	10 : 100	0·20	0·35	0·02	
Aluminium sulphocyanide	10 : 100	2·02	4·50	0·02	
Thiocarbamide	10 : 100	0·83	1·87	0·79	80° F.
Thiosinamine	1 : 100	0·40	0·08	0·008	
,,	5 : 100	1·90	0·35	0·05	
,,	10 : 100	3·90	0·72	0·09	

THERMOMETRIC TABLES.

SHOWING THE ASSIMILATION OF THE THERMOMETERS IN USE THROUGHOUT THE WORLD.

Centigrade.	Réaumur.	Fahrenheit.	Centigrade.	Réaumur.	Fahrenheit.
100	80·0	212·0	49	39·2	120·2
99	79·2	210·2	48	38·4	118·4
98	78·4	208·4	47	37·6	116·6
97	77·6	206·6	46	36·8	114·8
96	76·8	204·8	45	36·0	113·0
95	76·0	203·0	44	35·2	111·2
94	75·2	201·2	43	34·8	109·4
93	74·4	199·4	42	33·6	107·6
92	73·6	197·6	41	32·8	105·8
91	72·8	195·8	40	32·0	104·0
90	72·0	194·0	39	31·2	102·2
89	71·2	192·2	38	30·4	100·4
88	70·4	190·4	37	29·6	98·6
87	69·6	188·6	36	28·8	96·8
86	68·8	186·8	35	28·0	95·0
85	68·0	185·0	34	27·2	93·2
84	67·2	183·2	33	26·4	91·4
83	66·4	181·4	32	25·6	89·6
82	65·6	179·6	31	24·8	87·8
81	64·8	177·8	30	24·0	86·0
80	64·0	176·0	29	23·2	84·2
79	63·2	174·2	28	22·4	82·4
78	62·4	172·4	27	21·6	80·6
77	61·6	170·6	26	20·8	78·8
76	60·8	168·8	25	20·0	77·0
75	60·0	167·0	24	19·2	75·2
74	59·2	165·2	23	18·4	73·4
73	58·4	163·4	22	17·6	71·6
72	57·6	161·6	21	16·8	69·8
71	56·8	159·8	20	16·0	68·0
70	56·0	158·0	19	15·2	66·2
69	55·2	156·2	18	14·4	64·4
68	54·4	154·4	17	13·6	62·6
67	53·6	152·6	16	12·8	60·8
66	52·8	150·8	15	12·0	59·0
65	52·0	149·0	14	11·2	57·2
64	51·2	147·2	13	10·4	55·4
63	50·4	145·4	12	9·6	53·6
62	49·6	143·6	11	8·8	51·8
61	48·8	141·8	10	8·0	50·0
60	48·0	140·0	9	7·2	48·2
59	47·2	138·2	8	6·4	46·4
58	46·4	136·4	7	5·6	44·6
57	45·6	134·6	6	4·8	42·8
56	44·8	132·8	5	4·0	41·0
55	44·0	131·0	4	3·2	39·2
54	43·2	129·2	3	2·4	37·4
53	42·4	127·4	2	1·6	35·6
52	41·6	125·6	1	0·8	33·8
51	40·8	123·8	0	0·0	32·0
50	40·0	122·0			

THERMOMETRIC RULES

The following rules for the rapid conversion of degrees in one system into another will be found useful :—

To Convert Centigrade into Reaumur:
Degrees Réaumur × 4 ÷ 5.
Ex.—80° R. × 4 ÷ 5 = 64° C.

To Convert Centigrade into Fahrenheit:
Degrees Centigrade (× 9 ÷ 5) + 32.
Ex.—80° C. × 9 ÷ 5 = 144 + 32 = 176° F.

To Convert Reaumur into Centigrade
Degrees Reaumur × 5 ÷ 4.
Ex.—60° R. × 5 ÷ 4 = 75° C.

To Convert Fahrenheit into Centigrade:
(Degrees Fahr.—32) × 5 ÷ 9.
Ex.—100° F. − 32 = 78 × 5 ÷ 9 = 43·3° C.

To Convert Reaumur into Fahrenheit:
Degrees Reaumur (× 9 ÷ 4) + 32.
Ex.—16° R. × 9 ÷ 4 = 36 + 32 = 68° F.

To Convert Fahrenheit into Reaumur:
(Degrees Fahrenheit—32) ÷ 9 × 4.
Ex.—95° F. − 32 = 63 ÷ 9 × 4 = 28° R.

DISTRIBUTION OF THE COLOURS IN THE SPECTRUM.

(According to Listing.)

		Wave length			Wave length
	Limit ...	819·8		Limit ...	491·9
Brown—	Middle ...	768·6	Cyan Blue—	Middle ...	473·0
	Limit ...	723·4		Limit ...	455·5
Red—	Middle ...	683·2	Indigo —	Middle ...	439·2
	Limit ...	647·2		Limit ...	424·0
Orange—	Middle ...	614·9	Violet—	Middle ...	409·9
	Limit ...	585·6		Limit ...	396·7
Yellow—	Middle ...	559·0	Lavender—	Middle ...	384·3
	Limit ...	534·7		Limit ...	372·6
Green—	Middle ...	512·4			

WAVE LENGTHS OF BRIGHT LINES OF ELEMENTS USED IN PLOTTING OUT THE SPECTRUM.

(IN TEN-MILLIONTHS OF A MILLIMETRE, ANGSTROM UNITS.)

TABLE I.

Name of line.	Colour.	Salts used.	Wave lengths $= \lambda$
Lithium	Red	Lithium chloride or Nitrate ...	6705
,,	Orange	,, ,, ,, ,, ...	6102
D	,,	Sodium chloride or bicarbonate	5893
"Little b"	Green	Magnesium ribbon	5183
Strontium	Blue	Strontium chloride or metal ...	4607
Calcium	,,	Calcium nitrate or chloride ...	4227
Potassium	Violet	Potassium chloride	4080

Table I. has been drawn up so as to enable any one with nothing more than an ordinary Bunsen gas burner to construct a chart, by means of which the position of any Fraunhofer line in the spectrum may be determined with sufficient accuracy for all photographic purposes. The salts should be dissolved in distilled water so as to form a saturated solution, a narrow loop of copper or iron wire should be wound with fibrous asbestos, and this repeatedly heated in the Bunsen and allowed to cool. The spectroscope should be arranged so as to give a sharp spectrum of the gas flame, the slit of the spectroscope being closed as much as possible, the asbestos, saturated with the salt solution, should be inserted in the flame opposite the slit, slightly below it and below the top of the flame, and then the position of the bright line read off on the scale of the spectroscope. If only one side of the jaws of the spectroscope is moveable, it will be found on examination that, on opening the slit, a bright line will broaden, but on one side only, all readings must be taken from the side that does not move. Assuming that a moveable scale is used, it is as well to fix the D or sodium line at a given number, say, 5 or 10. The more accurately the scale is divided and the greater the number of the divisions, and the greater the number of lines observed, the more accurate will be the results obtained; but Table I. will give sufficient accuracy to enable anyone to determine the absorption of trichomatic filters or the sensitiveness of colour-sensitised plates.

Table II. will give the data, most easily obtained if a small induction coil is used. A small coil, giving a fat ½ or ¾ in. spark and actuated by three bichromate bottles will suffice to show the lines in this table. The hydrogen tube is, of course, of the well-known Plücker or Salet form. The magnesium may be used in twisted spirals of ribbon, but preferably in rod form, and the rods should be filed to comparatively sharp points. The constricted portion of the vacuum tube and the points of the magnesium rod should be

placed parallel to and not at right angles to the slit, thus giving more brilliant illumination. In photographing the spectra, obtained as above, it is advisable to use a sliding dark slide, so that several spectra can be obtained on one plate, but care should be taken to wedge the plate firmly so that it cannot shift; and with each exposure the scale should be impressed overlapping the spectrum.

It is as well to point out that in most cases a faint continuous spectrum will be observed or photographed, particularly if the slit is at all widely opened, but the lines can be easily distinguished. When burning magnesium, this continuous spectrum is fairly brilliant, but the principal line λ 518.3 is easily seen; close to this, on the blue side, will be seen a very brilliant and wide band, due to the incandescent MgO, the edge of this band towards the red has the wave length λ 5,007. The spark spectrum of magnesium is always very clear and sharp, and is characterised by the absence of the continuous spectrum, and λ 4,481 is very brilliant and broad, and when photographed the middle should be measured.

TABLE II.

C	Red	Hydrogen tube	6563
"Little b"	Green	Magnesium rod	5183
F	Bluish-green	Hydrogen tube	4861
Magnesium	Blue	Magnesium rod	4481
G	,,	Hydrogen tube	4308
"Little h"	,,	,, ,, ...	4102

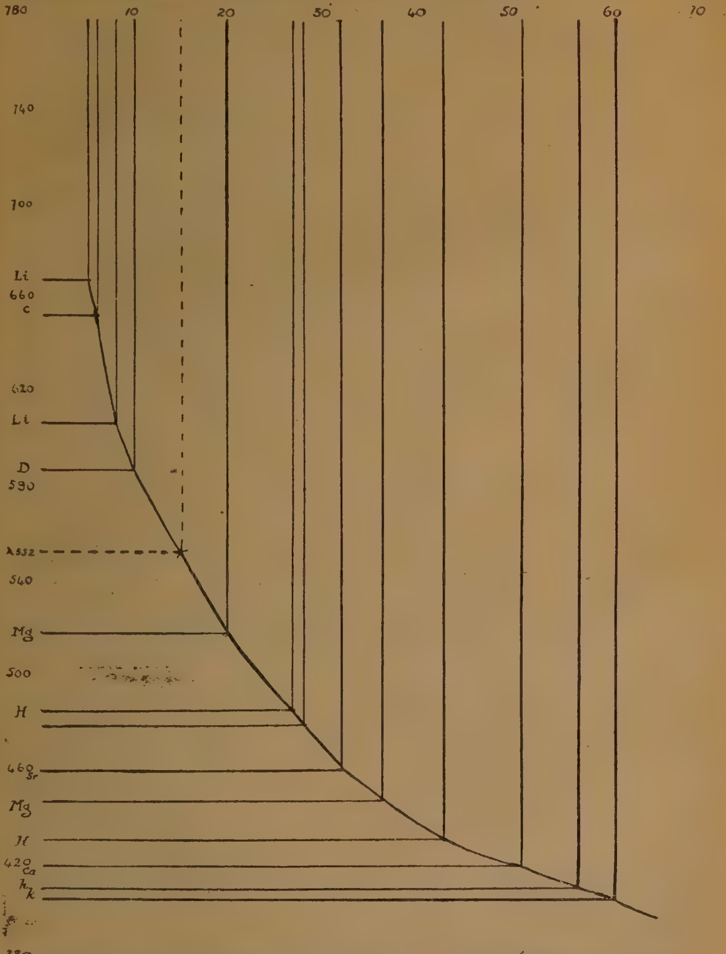
In order to find the wave length of any observed and unknown line, it is necessary to use an interpolation chart, and for this purpose squared paper should be obtained from any chemical apparatus dealer, and along the longer side should be marked the wave lengths, ranging from λ 4,000 to λ 7,800; on one, or both sides, should be marked the numbers of the scale. A straight line should be drawn from the wave length till it cuts another straight line, drawn at right angles, from the number of the scale. If this is done (as in the diagram herewith), for all the lines found as described above, and the points of intersection of the lines be joined up by a curve, the chart will be complete.

To find the wave length of any strange line, it is only necessary to rule a straight line from the scale number till it cuts the curve, when another, drawn at right angles to the base of wave lengths, will give the required reading. In the chart a hypothetical line was observed at Scale No. 15, and the dotted line was drawn till it cut the curve in X, and from this another dotted line was dropped, and the wave length found to be λ 552.

It is obvious that the larger the ruled paper (and several sheets may be mounted on a card) the greater will be the extension of the wave length scale and the empirical scale, and consequently the more accurate the reading.

For those requiring great accuracy of reading and a much greater

number of lines, reference should be made to "An Introduction to the Study of Spectrum Analysis" (Watts): "Beiträge zur Photochemie



und Spectralanalyse" (Eder and Valenta), and "Studies of Gases" (Travers); or to Baly's "Spectroscopy" (Longman.)

FREEZING MIXTURES.

The following mixtures will be found useful where ice is not readily obtainable—

	Ingredients.	Parts by Weight.	The Temperature at starting being 50° Fahr. the thermometer sinks.	Diminution of Temperature.
1	Water	1	From +50° to + 4°	46° Fahr.
	Nitrate of ammonia	1		
2	Water	16	„ +50° „ +10°	40° „
	Saltpetre	5		
	Chloride of ammonium (sal ammoniac)	5		
3	Water	1	„ +50° „ + 7°	43° „
	Nitrate of ammonia	1		
	Carbonate of soda	1		
4	Snow	2	„ 32° „ − 5°	37° „
	Chloride of sodium	1		
5	Snow	2	„ +32° „ −50°	82° „
	Crystallised chloride of calcium	3		
6	Crystallised sulphate of soda	8	„ + 0° „ 0°	50° „
	Hydrochloric acid	5		

EXPOSURE TABLES.

(Eder.)

The length of exposure depends upon the colour and the illumination of the object, on the ratio aperture of the lens, the brightness of the light and the sensitiveness of the plate.

The following table gives the exposures for slow plates of about 5 Hurter and Driffield, in bright sunshine from 9 a.m. to 3 p.m. during the months of April, May, June, July, and August. From sunrise to 9 a.m., and from 3 p.m. to sunset, the exposures must be increased. During March and September, from 10 a.m. to 2 p.m., the exposures given should be increased one and a half times, and during the remaining months—January, February, October, November, and December—the exposures should be approximately doubled.

As a rule, in diffused daylight (not sunlight), the exposure should be twice as long as in direct sunlight.

An example will make this table clear. If a lens is used working at an aperture of *f*/32, this aperture is found in the first column, and the exposure for an open landscape will be ¼ second if the light is good and in the middle of the day. If *f*/64 is used, the exposure would be one second. If, in the last case, there were dark foliage in the foreground, the exposure would be prolonged to six seconds.

If a plate of higher speed is used, the exposure must be decreased in direct ratio to the speed of the plate, thus a plate of 100 H. and D. will require twenty times less exposure.

Ratio Aperture.	Sea and Sky.	LANDSCAPES				INTERIORS.				PORTRAITS.			
		Open Landscape.	Landscape with dense foliage in foreground	Under trees.		Bright Interiors.		Dark Interiors.		Portraits in bright diffused light outdoors.	Portraits in good studio light.	Portraits in room.	
	sec.	sec.	sec.	min.	sec.	min.	sec	hrs.	min.	sec.	sec.	min.	sec.
F/5·6	$\frac{1}{400}$	$\frac{1}{120}$	$\frac{1}{20}$	—	4	—	4	—	1	$\frac{1}{12}$	$\frac{3}{8}$	—	$1\frac{1}{2}$
F/8	$\frac{1}{200}$	$\frac{1}{64}$	$\frac{1}{10}$	—	8	—	8	—	2	$\frac{1}{6}$	$\frac{3}{4}$	—	3
F/11·3	$\frac{1}{100}$	$\frac{1}{32}$	$\frac{1}{5}$	—	16	—	16	—	4	$\frac{1}{3}$	$1\frac{1}{2}$	—	6
F/16	$\frac{1}{50}$	$\frac{1}{16}$	$\frac{2}{5}$	—	32	—	32	—	8	$\frac{2}{3}$	3	—	12
F/22·6	$\frac{1}{25}$	$\frac{1}{8}$	$\frac{4}{5}$	1	4	1	4	—	16	$1\frac{1}{3}$	6	—	24
F/32	$\frac{1}{12}$	$\frac{1}{4}$	$1\frac{1}{2}$	2	8	2	8	—	32	$2\frac{2}{3}$	12	—	48
F/45	$\frac{1}{6}$	$\frac{1}{2}$	3	4	16	4	16	1	—	5	24	1	36
F/64	$\frac{1}{3}$	1	6	8	32	8	32	2	—	10	48	3	12

EXPOSURE TABLE FOR MOVING OBJECTS.[1]

The smaller the object appears on the ground glass of the camera, the smaller will be the visible movement of the same. As an object appears smaller (1) the further it is from the lens, and (2) the shorter the focus of the lens, it necessarily follows that both these factors have an influence on the visible movement of the image. On the other hand, it is obvious that to obtain a sharp image, the shorter must be the exposure, the greater the visible displacement of the image during a given time. The following table is based on these facts:—

Distance of object from Lens.	Rate of movement per second.		
	1 ft.	5 ft.	10 ft.
100 times the focus of lens	Exposure $\frac{1}{100}$ sec.	$\frac{1}{500}$ sec.	$\frac{1}{1000}$ sec.
500 " " " " "	$\frac{1}{20}$ "	$\frac{1}{100}$ "	$\frac{1}{200}$ "
1000 " " " " "	$\frac{1}{10}$ "	$\frac{1}{50}$ "	$\frac{1}{100}$ "

The use of this table is simple: if a horse is moving at the rate of 5 ft. per second, at a distance of 1,000 times the focus of the lens away, the image will be sufficiently sharp if the exposure is 1-50th sec. If, however, the horse is only 100 times the focus distant (i.e., 10 times nearer), then the exposure should be only 1-500th sec. (i.e., 10 times shorter). From this it follows that it is more difficult to obtain good instantaneous pictures the nearer the object is and the longer the focus of the lens. If a moving object is taken instantaneously, the image will be sufficiently sharp when the displacement of the outlines of the same does not amount to more than 1-250th of an inch.

A TABLE OF POISONS AND ANTIDOTES. Compiled by Mr. J. V. ELSDEN.

	Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Vegetable Acid	OXALIC ACID, including POTASSIUM OXALATE	1 drachm is the smallest fatal dose known.	Hot burning sensation in throat and stomach; vomiting, cramps, and numbness.	Chalk, whiting, or magnesia suspended in water. Plaster or mortar can be used in emergency.
Caustic Alkalies.	AMMONIA POTASH SODA	Vapour of ammonia may cause inflammation of the lungs.	Swelling of tongue, mouth, and fauces; often followed by stricture of the œsophagus.	Vinegar and water.
Metallic Salts.	MERCURIC CHLORIDE	3 grains the smallest known fatal dose.	Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	White and yolk of raw eggs with milk. In emergency, flour paste may be used.
	ACETATE OF LEAD	The sub-acetate is still more poisonous.	Constriction in the throat and at pit of stomach; crampy pains and stiffness of abdomen; blue line round the gums.	Sulphates of soda or magnesia Emetic of sulphate of zinc.
	CYANIDE OF POTASSIUM	*a.* Taken internally, 3 grs. fatal.	Insensibility, slow gasping respiration, dilated pupils, and spasmodic closure of the jaws.	No certain remedy; cold affusion over the head and neck most efficacious.
		b. Applied to wounds and abrasures of the skin.	Smarting sensation.	Sulphate of iron should be applied immediately.
	BICHROMATE OF POTASSIUM	*a.* Taken internally.	Irritant pain in stomach and vomiting.	Emetics and magnesia, or chalk.
		b. Applied to slight abrasions of the skin.	Produces troublesome sores and ulcers.	
	NITRATE OF SILVER		Powerful irritant.	Common salt to be given immediately, followed by emetics.
Concentrated Mineral Acids.	NITRIC ACID	2 drachms have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe, and violent inflammation.	Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
	HYDROCHLORIC ACID	½ ounce has caused death.		
	SULPHURIC ACID	1 drachm has been fatal.		
	ACETIC ACID, concentrated, has as powerful an effect as the mineral acids.			
	IODINE	Variable in its action; 3 grains have been fatal	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged and gruel arrowroot, and starch given freely.
	ETHER	When inhaled.	Effects similar to chloroform.	Cold affusion and artificial respiration.
	PYROGALLOL	2 grains sufficient to kill a dog.	Resembles phosphorous poisoning	No certain remedy. Speedy emetic desirable.

COMPARATIVE TABLE.

(SHEWING THE DIFFERENT SPEEDS AND COLOUR SENSITIVENESS OF VARIOUS PLATES TO DIFFERENT LIGHTS).—EDER

Kind of Plate.	Inertia. in Scheiner degrees.		Relative Sensitiveness $\frac{\text{Blue}}{\text{Yellow}}$.		
	Benzine light. 1m. distant.	By daylight (equal to an ordinary plate	Direct Benzine light. 0·3m. distant.	Reflected from white paper. Diffused daylight.	Reflected from white paper. Magnesium light.
Commercial ortho (to be used without a screen)					
Maker A	19°	11–12°	$\frac{1}{1\cdot7}-\frac{1}{5\cdot5}$	$\frac{2\cdot7}{1}$	$\frac{1\cdot3-1\cdot6}{1}$
,, B	13°	11–12°	$\frac{1}{1\cdot3}$	$\frac{6-7}{1}$	$\frac{4\cdot3-5}{1}$
,, C	15°	9–10°	$\frac{1}{3}$	$\frac{2\cdot8}{1}$	$\frac{1\cdot[illegible]5}{1}$
,, D (erythrosine plate with blue sensitiveness strongly depressed with yellow dye)	14°	7–8°	$\frac{1}{8}$	$\frac{1\cdot2-1\cdot3}{1}$	—
Inferior orange sensitive plate	10°	7°	$\frac{2\cdot1-2\cdot4}{1}$	$\frac{60}{1}$	$\frac{20}{1}$
Medium panchromatic (emulsion sensitised)...	17°	10–11°	$\frac{1}{2\cdot1}$	$\frac{7\cdot1}{1}$	—
Good panchromatic plate (bathed with orthochrome, ethyl red or pinachrome)	18–19°	11°	$\frac{1}{4}-\frac{1}{5}$	$1-\frac{1}{1\cdot3}$	—

EQUATIONS RELATING TO FOCI, &c.

THE following simple optical formulæ and calculations, worked out by Mr. J. A. C. Branfill, will prove useful in many branches of photography, especially where several lenses of varying foci are in constant use for a variety of purposes :—

Let p = Principal focus.
F = Greater conjugate do.
f = Lesser do. do.
$D = F + f$ = distance of image from object.
r = Ratio of any dimension in original to the same dimension in copy (in case of reduction), or *vice versâ* (in case of enlargement).
a = Effective diameter of diaphragm.
U. S. No. = 'Uniform System' No. of do.
x = Comparative exposure required.

Then
$$p = D \times \frac{r}{(r+1)^2} = \frac{Ff}{D} = \frac{F}{r+1} = \frac{rf}{r+1}$$
$$F = p(r+1) = \frac{pf}{f-p} = rf = \frac{rD}{r+1}$$
$$f = p \times \frac{(r+1)}{r} = \frac{pF}{F-p} = \frac{D}{r+1} = \frac{F}{r}$$
$$D = p \times \frac{(r+1)^2}{r} \qquad f(r+1) = p\left(2 + r + \frac{1}{r}\right)$$
$$r = \frac{F-p}{p} = \frac{p}{f-p} = \frac{F}{f}$$
$$\text{U. S. No.} = \frac{p^2}{16a^2}$$
$$x = \frac{f^2}{16a^2} = \frac{p^2}{16a^2} \times \frac{(r+1)^2}{r^2}$$

N.B.—For ordinary landscape work, where r is greater than 20 x may be taken as $\frac{p^2}{16a^2}$

NOTE.—In case the above may not be clear to some photographers, the following rules may be better understood :—

To find the principal focus of a lens (p), focus a near object in the camera, and measure the distance between it and the ground-glass (D); next find the proportion which any dimension in the object bears to the same dimension on the ground-glass (r). Thus, if the original dimension be four times as large as its reproduction, we say that r equals (=) 4. Multiply D by r, and divide the product by the square of a number greater by one than r, or $(r+1)$. This rule was lately published by Mr. Debenham.

To find the lesser conjugate focus (f) (if p and r are known) multiply p by the sum of $r+1$, and divide the product by r. Or divide D by $r+1$.

To find the greater conjugate focus (F) multiply p by $r+1$. Or multiply f by r.

To find D (the distance which the ground-glass should be from the object to be copied in order to get a given value for r) multiply p by the sum of $r + \frac{1}{r} + 2$.

To find r divide $F-p$ (the difference between F and p) by p. Or divide p by $f-p$. Or divide F by f.

To find x divide the square of f by 16 times the square of a (the diameter of aperture to lens).

For example: focus an object which is five inches high, so that it is one inch high on the ground glass; thus we know that $r = 5$. Next measure the distance between the object and the ground glass (D), which is found to be 45 inches.

Then $p = 45 \times$ (multiplied by) $5 \div$ (divided by) $6 \times 6 = 6\frac{1}{4}$ inches.
$f = 6\frac{1}{4} \times 6 \div 5 = 7\frac{1}{2}$ inches. Or $f = 45 \div 6 = 7\frac{1}{2}$ inches.
$F = 6\frac{1}{4} \times 6 = 37\frac{1}{2}$ inches. Or $F = 7\frac{1}{2} \times 5 = 37\frac{1}{2}$ inches.
$D = 6\frac{1}{4} \times (5 + \frac{1}{5} + 2) = 6\frac{1}{4} \times 7\frac{1}{5} = 45$ inches
$r = (37\frac{1}{2} - 6\frac{1}{4}) \div 6\frac{1}{4} = 5$. Or $r = 6\frac{1}{4} \div (7\frac{1}{2} - 6\frac{1}{4}) = 5$.

TABLE FOR ENLARGEMENTS.

Focus of Lens, inches.	TIMES OF ENLARGEMENT AND REDUCTION.							
	1 inches.	2 inches.	3 inches.	4 inches.	5 inches.	6 inches.	7 inches.	8 inches.
3	6 6	9 4½	12 4	15 3¾	18 3⅗	21 3½	24 3 3/7	27 3⅜
3½	7 7	10½ 5¼	14 4⅔	17½ 4⅜	21 4⅕	24½ 4 1/12	28 4	31½ 3 15/16
4	8 8	12 6	16 5⅓	20 5	24 4⅘	28 4⅔	32 4 4/7	36 4½
4½	9 9	13½ 6¾	18 6	22½ 5⅝	27 5⅖	31½ 5¼	36 5 1/7	40½ 5 1/16
5	10 10	15 7½	20 6⅔	25 6¼	30 6	35 5⅚	40 5 5/7	45 5⅝
5½	11 11	16½ 8¼	22 7⅓	27½ 6⅞	33 6⅗	38½ 6 5/12	44 6 2/7	49½ 6 3/16
6	12 12	18 9	24 8	30 7½	36 7⅕	42 7	48 6 6/7	54 6¾
7	14 14	21 10½	28 9⅓	35 8¾	42 8⅖	49 8⅙	56 8	63 7⅞
8	16 16	24 12	32 10⅔	40 10	48 9⅗	56 9⅓	64 9 1/7	72 9
9	18 18	27 13½	36 12	45 11¼	54 10⅘	63 10½	72 10 2/7	81 10⅛
10	20 20	30 15	40 13⅓	50 12½	60 12	70 11⅔	80 11 3/7	90 11¼
11	22 22	33 16½	44 14⅔	55 13¾	66 13⅕	77 12⅚	88 12 4/7	99 12⅜
12	24 24	36 18	48 16	60 15	72 14⅖	84 14	96 13 5/7	108 13½

THE object of this table is to enable any manipulator who is about to enlarge (or reduce) a copy any given number of times, to do so without troublesome calculation. It is assumed that the photographer knows exactly what the focus of his lens is, and that he is able to measure accurately from its optical centre. The use of the table will be seen from the following illustration :—A photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of six inches equivalent focus. He must, therefore, look for 4 on the upper horizontal line, and for 6 in the first vertical column, and carry his eye to where these two join, which will be at 30—7½. The greater of these is the distance the sensitive plate must be from the centre of the lens ; and the lesser, the distance of the picture to be copied. To *reduce* a picture any given number of times the same method must be followed, but in this case the greater number will represent the distance between the lens and the picture to be copied ; the latter, that between the lens and the sensitive plate. This explanation will be sufficient for every case of enlargement or reduction.

RELATIVE EXPOSURES FOR VARYING PROPORTIONS OF IMAGE TO THE ORIGINAL.

[The following paper was read before the Royal Photographic Society by Mr. W. E. Debenham. Its usefulness would be diminished by abbreviation, hence we reproduce it in full.—Ed.]

WHEN an enlarged photograph has to be made, either from a negative or print, it is commonly understood that the greater the degree of enlargement the longer will be the exposure required, but I have generally found only the vaguest ideas to exist as to the amount by which such exposure has to be prolonged. Sometimes, indeed, it is assumed that the exposure will be in direct inverse proportion to the area covered, so that a copy of twice the linear dimensions of the original—covering, as it does, the area of four times the size—would require an exposure of four times that sufficing for a copy of the same size. This calculation, however, omits to recognise an important factor, and leads to serious error, the actual exposure required in the case mentioned (assuming the same lens and stop to be used) being not four times, but two and a quarter times, that of a copy of same size; whilst, when we come to high degrees of enlargement, the error would amount to an indication of nearly four times the exposure actually required.

To find the relative exposure, add one to the number of times that the length of the original is contained in the length of the image, and square the sum. This will give the figure found in the third column of the annexed table.

As examples: suppose a copy is wanted having twice the linear dimensions of the original. Take the number 2, add 1 to it, and square the sum, $3^2=9$. Again, if a copy is to be of eight times the linear dimensions of the original, take the number 8, add 1, and square the sum, $9^2=81$. Copies repectively twice and eight times the size (linear) of the original will thus require relative exposures of 9 and 81—*i.e.*, the latter will require nine times the exposure of the former.

It is convenient to have a practical standard for unity. An image of the same size as the original is a familiar case, and serves as such standard. By dividing the figures in the third column by four, we get at the figures in the last column, which represent the exposure required for varying degrees of enlargement or reduction, compared with the exposure for a copy of the same size.

The table is carried up to enlargements of thirty diameters; that is about the amount required for enlarging a *carte-de-visite* to life size.

The exposures required in reductions do not vary at all to the same extent that they do in enlargements. It has, therefore, not been thought necessary to fill in the steps between images of $\frac{1}{10}$ and $\frac{1}{20}$, and between $\frac{1}{20}$ and $\frac{1}{30}$ of the size of the original. Beyond $\frac{1}{30}$ there is scarcely any perceptible difference in the exposure until disturbance comes in from another cause, a considerable distance of illuminated atmosphere (haze or fog) intervening.

The figures in the second column will also serve as a table for distances from the lens to the plate and to the original, all that is necessary being to multiply by the principal focus of the lens in use. In the case of enlargements the figures less than 2 must be multiplied to get the

distance from the original to the lens, and the figures greater than 2 or the distance from lens to image. For reductions the figures less than 2, multiplied by the principal focus of the lens, yield the distance from lens to plate; and the figures higher than 2, similarly multiplied, give the distance of original from lens.

Proportion of image to original (linear).	Distance of image from lens* in terms of principal focus.	Proportionate exposures.	Exposures proportioned to that required for copying same size.
$\frac{1}{30}$	$1\frac{1}{30}$	1·07	·27
$\frac{1}{20}$	$1\frac{1}{20}$	1·10	·28
$\frac{1}{10}$	$1\frac{1}{10}$	1·21	·3
$\frac{1}{8}$	$1\frac{1}{8}$	1·27	·31
$\frac{1}{6}$	$1\frac{1}{6}$	1·36	·34
$\frac{1}{4}$	$1\frac{1}{4}$	1·56	·39
$\frac{1}{2}$	$1\frac{1}{2}$	2·25	·56
$\frac{3}{4}$	$1\frac{3}{4}$	3·06	·76
(Same size) 1	2	4	1
2	3	9	2·25
3	4	16	4
4	5	25	6·25
5	6	36	9
6	7	49	12·25
7	8	64	16
8	9	81	20·25
9	10	100	25
10	11	121	30·25
11	12	144	36
12	13	169	42·25
13	14	196	49
14	15	225	56·25
15	16	256	64
16	17	289	72·25
17	18	324	81
18	19	361	90·25
19	20	400	100
20	21	441	110·25
21	22	484	121
22	23	529	132·25
23	24	576	144
24	25	625	156·25
25	26	676	169
26	27	729	182·25
27	28	784	196
28	29	841	210·25
29	30	900	225
30	31	961	240·25

* With a double lens it is usually sufficient to measure from the position of the diaphragm plate.

TABLE OF VIEW-ANGLES.

By Clarence E. Woodman, Ph.D.

Divide the Base* of the Plate by the Equivalent Focus of the Lens.

If the quotient is	The angle is	If the quotient is	The angle is	If the quotient is	The angle is
	Degrees.		Degrees.		Degrees.
·282	16	·748	41	1·3	66
·3	17	·768	42	1·32	67
·317	18	·788	43	1·36	68
·335	19	·808	44	1·375	69
·353	20	·828	45	1·4	70
·37	21	·849	46	1·427	71
·389	22	·87	47	1·45	72
·407	23	·89	48	1·48	73
·425	24	·911	49	1·5	74
·443	25	·933	50	1·53	75
·462	26	·954	51	1·56	76
·48	27	·975	52	1·59	77
·5	28	1·	53	1·62	78
·517	29	1·02	54	1·649	79
·536	30	1·041	55	1·678	80
·555	31	1·063	56	1·7	81
·573	32	1·086	57	1·739	82
·592	33	1·108	58	1·769	83
·611	34	1·132	59	1·8	84
·631	35	1·155	60	1·833	85
·65	36	1·178	61	1·865	86
·67	37	1·2	62	1·898	87
·689	38	1·225	63	1·931	88
·708	39	1·25	64	1·965	89
·728	40	1·274	65	2·	90

Example.—Given a lens of 13 inches equivalent focus; required the angle included by it on plates $3\frac{1}{4} \times 4\frac{1}{4}$.

Dividing 4·25 by 13, we have as quotient ·327—midway between the decimals ·317 and ·335 of our table; therefore the required angle is 18° 30′.

* More accurately the diagonal of the plate, inasmuch as the field of the lens is circular and if the corners of the plate are to be covered the angle embraced by the lens should be sufficient to cover the diagonal of the plate.

The lengths of the diagonals of the plates most commonly used are:—

$3\frac{1}{4} \times 3\frac{1}{4}$	diagonal	4·6	inches.	$6\frac{1}{2} \times 8\frac{1}{2}$	diagonal	10·7	inches
$3\frac{1}{4} \times 4\frac{1}{4}$	,,	5·3	,,	8×10	,,	12·4	,,
4×5	,,	6·4	,,	10×12	,,	15·6	,,
$4\frac{3}{4} \times 6\frac{1}{2}$	,,	8·0	,,	12×15		19·4	,,
5×7							

MR. E. M. NELSON'S TABLE OF DISTANCES FOR LANTERN PROJECTION.

Distance of Projection Lens from Screen, Mask being Three Inches.

Foci	4½		5		5½		6		7		8		9		10		11		12		14		15		16		18	
Disc.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
5	7	10½	8	9	9	7½	10	6	12	3	14	0	15	9	17	6	19	3	21		24	6	26	3	28	0	31	6
6	9	4½	10	5	11	5½	12	6	14	7	16	8	18	9	20	10	22	11	25		29	2	31	3	33	4	37	6
7	10	10½	12	1	13	3½	14	6	16	11	19	4	21	9	24	2	26	7	29		33	10	36	3	38	8	43	6
8	12	4½	13	9	15	1½	16	6	19	3	22	0	24	9	27	6	30	3	33		38	6	41	3	44	0	49	6
9	13	10½	15	5	16	11½	18	6	21	7	24	8	27	9	30	10	33	11	37		43	2	46	3	49	4	55	6
10	15	4½	17	1	18	9½	20	6	23	11	27	4	30	9	34	2	37	7	41		47	10	51	3	54	8	61	6
11	16	10½	18	9	20	7½	22	6	26	3	30	0	33	9	37	6	41	3	45		52	6	56	3	60	0	67	6
12	18	4½	20	5	22	5½	24	6	28	7	32	8	36	9	40	10	44	11	49		57	2	61	3	65	4	73	6
13	19	10½	22	1	24	3½	26	6	30	11	35	4	39	9	44	2	48	7	53		61	10	66	3	70	8	79	6
14	21	4½	23	9	26	1½	28	6	33	3	38	0	42	9	47	6	52	3	57		66	6	71	3	76	0	85	6
15	22	10½	25	5	27	11½	30	6	35	7	40	8	45	9	50	10	55	11	61		71	2	76	3	81	4	91	6
16	24	4½	27	1	29	9½	32	6	37	11	43	4	48	9	54	2	59	7	65		75	10	81	3	86	8	97	6
18	27	4½	30	5	33	5½	36	6	42	7	48	8	54	9	60	10	66	11	73		85	2	91	3	97	4	109	6
20	30	4½	33	9	37	1½	40	6	47	3	54	0	60	9	67	6	74	3	81		94	6	101	3	108	0	121	6
25	37	10½	42	1	46	3½	50	6	58	11	67	4	75	9	84	2	92	7	101		117	10	126	3	134	8	151	6
30	45	4½	50	5	55	5½	60	6	70	7	80	8	90	9	100	10	110	11	121		141	2	151	3	161	4	181	6
35	52	10½	58	9	64	7½	70	6	82	3	94	0	105	0	117	6	129	3	141		164	6	176	3	188	0	211	6
40	60	4½	67	1	73	9½	80	6	93	11	107	4	120	9	134	2	147	7	161		187	10	201	3	214	8	241	6
45	67	10½	75	5	82	11½	90	6	105	7	120	8	135	9	150	10	165	11	181		211	2	226	3	241	4	271	6
50	75	4½	83	9	92	1½	100	6	117	3	134	0	150	9	167	6	184	3	201		234	6	251	3	268	0	301	6

CONTINENTAL STOPS AND THEIR U.S. EQUIVALENTS.

MR. EDWARD M. NELSON says: "Photographers are frequently troubled by the Continental nomenclature of the stops, and wish to know the U.S. equivalents for them. The method of finding this out is very simple. All that is necessary is to divide f-4 by the ratio to be converted, and square the result. Example: required the U.S. equivalent of f-9:—

$$\frac{f}{4} \div \frac{f}{9} = \frac{f}{4} \times \frac{9}{f} = 2{\cdot}25;$$

the square of 2·25 is 5·06, the U.S. number required. The following is a table of the Continental stops more commonly met with, and also the Continental values of the U.S. ratios:—

Ratios. f divided by	Continental Values.	U.S. Values.	Ratios. f divided by	U.S. Values.	Continental Values.
4·5	512	1·26	2·828	·5	1250
6·3	256	2·48	4	1	625
7	204	3·06	5·66	2	312
7·2	193	3·24	8	4	156
7·7	168	3·71	11·31	8	78
9	128	5·06	16	16	39
12·5	64	9·77	22·6	32	20
14·5	47	13	32	64	9·77
18	32	20	45·3	128	4·88
25	16	39	64	256	2·44
36	8	81	90·5	512	1·22
50	4	156	...	...	...
71	2	315	...	...	...
100	1	625	...	...	...

"To find the f ratio for the U.S. values, multiply the U.S. value by 16 and the square root of the product is the required ratio. Example: What is the ratio of U.S. 32? 32 multiplied by 16 is 512, the square root of this is 22 6, the ratio required.

"To find the f ratio for the Continental stops, multiply the reciprocal of the square root of the Continental value by 100. Example: What is the f ratio of the Continental value 16? The square root of 16 is 4, the reciprocal of 4 is ·25, which, multiplied by 100, is 25, the ratio required.

"*Note.*—The Continental ratios of 512, 256, and 8, ought to be 4·4, 6·25, and 35, respectively. The figures in the list are those extracted from Continental opticians' catalogues."

TABLE OF DISTANCES FOR AN OBJECT OF SIXTY-EIGHT INCHES HEIGHT.

COMPUTED BY P. BROSIG.

EQUIVALENT FOCUS (INCHES).	HEIGHTS OF IMAGES (INCHES).																	
	1	2	3	4	6	8	10	12	14	16	20	24	28	32	40	48	56	68
2	138·0 2·0	70·0 2·1	47·3 2·1	36·0 2·1														
3	207·0 3·0	105·0 3·1	71·0 3·1	54·0 3·2	37·0 3·3													
4	276·0 4·1	140·0 4·1	94·7 4·2	72·0 4·2	49·3 4·4	38·0 4·5												
5	345·0 5·1	175·0 5·1	118·3 5·2	90·0 5·3	61·7 5·4	47·5 5·6	39·0 5·7											
6	414·0 6·1	210·0 6·2	142·0 6·3	108·0 6·4	74·0 6·5	57·0 6·7	46·8 6·9	40·0 7·1	35·1 7·2									
7	483·0 7·0	245·0 7·1	165·7 7·3	126·0 7·4	86·3 7·6	66·5 7·8	54·6 8·0	46·7 8·2	41·0 8·4	36·7 8·6								
8	552·0 8·1	280·0 8·2	189·3 8·4	144·0 8·5	98·7 8·7	76·0 8·9	62·4 9·2	53·3 9·4	46·9 9·6	42·0 9·9	35·2 10·4							
9	621·0 9·1	315·0 9·3	213·0 9·4	162·0 9·5	111·0 9·8	85·5 10·1	70·2 10·3	60·0 10·6	52·7 10·9	47·2 11·1	39·6 11·6							
10	690·0 10·1	350·0 10·3	236·7 10·4	180·0 10·6	123·3 10·9	95·0 11·2	78·0 11·5	66·7 11·8	58·6 12·1	52·5 12·4	44·0 12·9	38·3 13·5	34·3 14·1					
11	759·0 11·2	385·0 11·3	260·3 11·5	198·0 11·6	135·7 12·0	104·5 12·3	85·8 12·6	73·3 12·9	64·4 13·3	57·7 13·6	48·4 14·2	42·2 14·9	37·7 15·5	34·4 16·2				
12	828·0 12·2	420·0 12·4	284·0 12·5	216·0 12·7	148·0 13·1	114·0 13·4	93·6 13·8	80·0 14·1	70·3 14·5	63·0 14·8	52·8 15·5	46·0 16·2	41·1 16·9	37·5 17·6				
13	897·0 13·2	455·0 13·4	307·7 13·6	234·0 13·8	160·3 14·1	123·5 14·5	101·4 14·9	86·7 15·3	76·1 15·7	68·2 16·1	57·2 16·8	49·8 17·6	44·6 18·4	40·6 19·1	35·1 20·6			

Values are omitted in this space on account of the wide angle of lens required. (More than ninety degrees.)

14	996.0 14.2	490.0 14.4	331.3 14.6	252.0 15.7	172.7 14.8	133.0 15.6	109.2 16.1	93.3 16.5	82.0 16.9	73.5 17.3	61.6 18.0	53.7 18.9	19.8	43.7 20.6	37.8 22.2			
16	1104 16.2	560.0 16.5	378.7 16.7	288.0 16.9	197.3 17.4	152.0 17.9	124.8 18.4	106.7 18.8	93.7 19.3	84.0 19.8	70.4 20.7	61.3 21.6	54.9 22.6	50.0 23.5	43.2 25.4	38.7 27.3	35.4 29.2	
18	1242 18.3	630.0 18.5	426.0 18.8	324.0 19.1	222.0 19.6	171.0 20.1	140.4 20.6	120.0 21.2	105.4 21.7	94.5 22.2	79.2 23.3	69.0 24.4	61.7 25.4	56.2 26.5	48.6 28.6	43.5 30.7	39.9 32.8	36.0 36.0
20	1380 20.3	700.0 20.6	473.3 20.9	360.0 21.2	246.7 21.8	199.0 22.4	156.0 22.9	133.3 23.5	117.1 24.1	105.0 24.7	88.0 25.9	76.7 27.1	68.6 28.2	62.5 29.4	54.0 31.8	48.3 34.1	44.3 36.5	40.0 40.0
22	1518 22.3	770.0 22.6	520.7 23.0	396.0 23.3	271.3 23.9	209.0 24.6	171.6 25.2	146.7 25.9	128.9 26.5	115.5 27.2	96.8 28.5	84.3 29.8	75.4 31.1	68.7 32.4	59.4 35.9	53.2 37.6	48.7 40.1	44.0 44.0
24	1656 24.4	840.0 24.7	568.0 25.1	432.0 25.4	296.0 26.1	228.0 26.8	187.2 27.5	160.0 28.2	140.6 28.9	126.0 29.6	105.6 31.1	92.0 32.5	82.3 33.9	75.0 35.3	64.8 38.1	58.0 40.9	53.1 43.8	48.0 48.0
26	1794 26.4	910.0 26.8	615.3 27.1	468.0 27.5	320.6 28.3	247.0 29.0	202.8 29.8	173.3 30.6	152.3 31.3	136.5 32.1	114.4 33.6	99.7 35.2	89.1 36.7	81.2 38.2	70.2 41.3	62.8 44.4	57.6 47.4	52.0 52.0
28	1932 28.4	980.0 28.8	662.7 29.2	504.0 29.6	345.3 30.5	266.0 31.3	218.4 32.1	186.7 32.9	164.0 33.8	147.0 34.6	123.2 36.2	107.3 37.9	96.0 39.5	87.5 41.2	75.6 44.5	67.7 47.8	62.0 51.1	56.0 56.0
32	2208 32.5	1120 32.9	757.3 33.4	576.0 33.9	394.7 34.8	304.0 35.8	249.6 36.7	213.3 37.6	187.4 38.6	168.0 39.5	140.8 41.4	122.7 43.3	109.7 45.2	100.0 47.1	86.4 50.8	7.3 54.6	70.9 58.4	64.0 64.0
36	2484 36.5	1260 37.1	852.0 37.6	648.0 38.1	444.0 39.2	342.0 40.2	280.8 41.3	240.0 42.4	210.9 43.4	189.0 44.5	158.4 46.6	138.0 48.7	123.4 50.8	112.5 52.9	97. 57.2	87.0 61.4	79.7 65.6	72.0 72.0
44	3036 44.6	1540 45.3	1041 45.9	792.0 46.7	542.7 47.9	418.0 49.2	343.2 50.5	293.3 51.8	257.7 53.1	231.0 54.3	193.6 56.9	168.7 59.6	150.9 62.1	137.5 64.7	118.8 69.9	106.3 75.1	97.4 80.2	88.0 88.0
52	3588 52.8	1820 53.5	1231 54.3	936.0 55.1	641.3 56.6	494.0 58.1	405.6 59.6	346.7 61.2	304.6 62.7	273.0 64.2	228.8 67.3	199.3 70.4	178.3 73.4	162.5 76.5	140.4 82.6	125.7 88.7	115.1 94.8	104.0 104.0

This table gives, in inches, the distances from lens to object (greater conjugate focus, upper number) and from lens to ground glass (lesser conjugate focus, lower number) for different heights of images and different lengths of foci of lenses, when the height of object is 68 inches (=average height of man).

EXAMPLES.

Q.—What is the height of image of a person who is 133 inches distant from lens, when a lens of 14 inches focus is used

A.—The height of image in this case is 8 inches.

Q.—What are the distances between object, lens, and ground glass if the image of a person is to be 8 inches high and a 14 inches focus lens is employed?

A.—The distance from object to lens will be 133 inches, from lens to ground glass 15·6 inches.

TABLES OF DISTANCES AT AND BEYOND WHICH ALL OBJECTS ARE IN FOCUS.

Focal length of Lens in inches.	Ratios marked on Stops.													
	f/4	f/5·6	f/6	f/7	f/8	f/10	f/11	f/15	f/16	f/20	f/22	f/32	f/44	f/64
	Number of feet after which all is in focus.													
4	33	24	22	19	17	13	12	9	8	7	6	4	3	2
4¼	38	27	25	21	19	15	14	10	10	7	7	5	3½	2½
4½	42	30	28	24	21	17	15	11	11	8½	7½	5½	4	3
4¾	47	34	31	27	24	19	17	12	12	9½	8½	6	5	3
5	52	36	35	30	26	21	19	14	13	10½	9½	6½	5½	3½
5¼	57	40	38	33	28	23	21	15	14	11½	10½	7	5½	3½
5½	63	45	43	36	31	25	23	17	15	12½	11½	7½	6	4
5¾	68	50	46	38	34	27	25	18	17	13½	13	8½	6½	4
6	75	54	50	42	38	30	28	20	19	15	14	9	7	4½
6¼	81	58	54	46	40	32	29	22	20	16	15	10	7½	5
6½	87	62	58	50	44	35	32	23	22	17½	16	11	8	5½
6¾	94	67	63	54	47	38	34	25	24	19	17	12	8½	6
7	101	72	68	58	51	40	37	27	25	20	18	12½	9	6
7¼	109	78	73	62	54	44	39	29	27	22	20	13½	10	6½
7½	117	83	78	6[illegible]	58	47	42	31	29	24	21	14½	10½	7
7¾	124	90	83	71	62	50	45	33	31	25	22	15½	11	7½
8	132	96	88	76	68	52	48	36	32	28	24	16	12	8
8¼	141	100	94	80	71	56	51	37	35	29	25	17½	12½	8½
8½	150	104	100	84	76	60	56	40	38	30	27	19	13½	9
8¾	156	111	104	89	78	63	57	42	39	32	29	20	14	10
9	168	120	112	96	84	67	61	45	42	34	31	21	15	10½
9¼	180	127	116	101	90	71	65	47	45	35	32	22	16	11
9½	190	133	125	107	95	75	68	50	47	37	34	24	17	12
9¾	197	141	131	11[illegible]	99	79	72	52	50	39	36	25	18	12½
10	208	148	140	120	104	83	75	55	52	42	38	26	19	13

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"Etc." following the number of an entry, is inserted to indicate that other formulæ will be found in the "Makers'" section.

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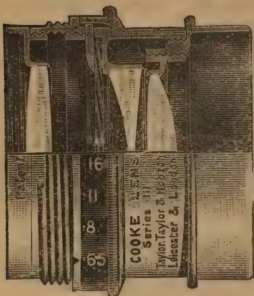
CONTRIBUTORS.

COOKE LENSES

Cooke Lenses consist of three simple glasses, uncemented, and therefore transmit more light than do any of the usual complex forms, while our unique system of screw adjustments enables us to reach a higher standard of excellence than can be attained by any other means. Comparison will prove that Cooke Lenses are the simplest and best.



Series III. f/6·5.

Series V. f/8.

These series are the best for those desiring "universal" anastigmats of the very highest quality. They are designed for general photography, landscapes, interiors, street scenes, and all rapid work requiring uniformly sharp definition. The series V lenses are similar to the series III except for their smaller apertures and mountings. They are particularly suitable for architectural photography, copying, enlarging, and every kind of accurate reproduction work.

Series III. Full Aperture f/6·5.

DIMENSIONS ARE IN INCHES.				PRICES.	
Approximate equivalent focus.	Focus measured from flange shoulder.	With large apertures to cover plates.	Stopped down to cover plates.	Lens without flange.	Standard flange extra.
4¼	3·9	3¼ by 3¼	5 by 4	£3 12 0	2/-
5	4·62	4¼ ,, 3¼	6½ ,, 4¾	4 0 0	2/-
5½	4·95	4¼ ,, 3¼	8 ,, 5	4 5 0	2/-
6	5·25	5 ,, 4	8½ ,, 6½	4 10 0	2/-
7½	6·6	6½ ,, 4¾	10 ,, 8	5 10 0	2/-
8¼	7·5	7 ,, 5	10 ,, 8	6 1 0	2/-
11	9·6	8½ ,, 6½	14 ,, 11	10 10 0	2/3
13	12·0	10 ,, 8	17 ,, 14	15 0 0	2/6

Series V. Full Aperture f/8.

Approximate equivalent focus.	Focus measured from flange shoulder.	With large apertures to cover plates.	Stopped down to cover plates.	Lens without flange.	Standard flange extra.
4¼	3·8	3¼ by 3¼	5 by 4	£2 18 0	2/-
5	4·5	4¼ ,, 3¼	6½ ,, 4¾	3 3 0	2/-
5½	5·0	4¼ ,, 3¼	7 ,, 5	3 8 0	2/-
6	5·5	5 ,, 4	8 ,, 5	3 12 0	2/-
7½	6·9	6½ ,, 4¾	10 ,, 8	4 10 0	2/-
9	8·3	8 ,, 5	12 ,, 10	5 10 0	2/-
11	10·0	8½ ,, 6½	15 ,, 12	7 15 0	2/-
13	11·95	10 ,, 8	17 ,, 14	10 0 0	2/-
16	15·0	12 ,, 10	20 ,, 18	15 0 0	2/6
18	16·45	15 ,, 12	24 ,, 20	18 10 0	3/-
24	22·35	18 ,, 16	27 ,, 24	30 0 0	4/-

COOKE LENSES

Series IV. Aperture f/5·6. Series II. Aperture f/4·5.

These series are designed for high-speed photography, for the finest portraiture, and for difficult subjects under poor conditions of lighting. The 8-inch and 13-inch lenses of the Series II. are provided with a means of adjusting the back glass. This enables the photographer to secure at will uniform sharp definition, or to introduce the softness often desired in portraiture.

Series IV. f/5.6.				Series II. f/4·5.			
Approximate equivalent focus.	Size of plate.	Lens without flange.	Standard flange extra.	Approximate equivalent focus.	Size of plate.	Lens without flange.	Standard flange extra.
6	5 by 4	£5 0 0	2/-	6	5 by 4	£7 15 0	2/-
8	6½ ,, 4¾	7 15 0	2/-	8	6½ ,, 4¾	10 10 0	2/3
11	8½ ,, 6½	12 10 0	2/6	13	8½ ,, 6½	21 0 0	4/-
13	10 ,, 8	17 0 0	3/-				

FOCUSSING COOKE LENSES

provide a means of focussing objects as close as three yards without moving the lens, merely by turning the graduated hood shown in the illustration. When required these lenses can be fitted in a special sunk mount reducing the projection from the lens-board to 7-16ths of an inch. Price, **4/6** extra.

FOCUSSING COOKE LENS
Series III. f/6·5

Series.	Dimensions in Ins.		Prices.	
	Equivalent focus.	With large apertures to cover plates.	Lens without flange.	Standard flange extra.
III. f/6·5	4¼	3¼ by 3¼	£3 17 0	2/-
	5	4¼ ,, 3¼	4 5 0	2/-
	5½	4¼ ,, 3¼	4 10 0	2/-
	6	5 ,, 4	4 15 0	2/-
V. f/8	4¼	3¼ ,, 3¼	3 3 0	2/-
	5	4¼ ,, 3¼	3 8 0	2/-
	5½	4¼ ,, 3¼	3 13 0	2/-
	6	5 ,, 4	3 17 0	2/-

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Size 20 by 20, in every respect like the above, with roller shutter back holding carriers for 15 by 12 (Large Panel), 12 by 10, 10 by 8 and $8\frac{1}{2}$ by $6\frac{1}{2}$ plates, and back with two slides for $8\frac{1}{2}$ by $6\frac{1}{2}$ and $6\frac{1}{2}$ by $4\frac{3}{4}$ plates, with a four-legged stand. Extension of bellows, 60 inches £35

Size 15 by 15, with a three-legged stand, otherwise same as larger size, with extra roller shutter back, holding carriers for 12 by 10, 10 by 8 and $8\frac{1}{2}$ by $6\frac{1}{2}$ plates, and one back to take two slides for $8\frac{1}{2}$ by $6\frac{1}{2}$ and $6\frac{1}{2}$ by $4\frac{3}{4}$ plates. Extension of bellows, 54 inches £27

Size 12 by 12, in every respect like the 15 by 15 Camera, with carriers to hold 10 by 8, and $8\frac{1}{2}$ by $6\frac{1}{2}$ plates, and two slides for $8\frac{1}{2}$ by $6\frac{1}{2}$ and $6\frac{1}{2}$ by $4\frac{3}{4}$ plates. Extension of bellows, 48 inches... ... ... £25

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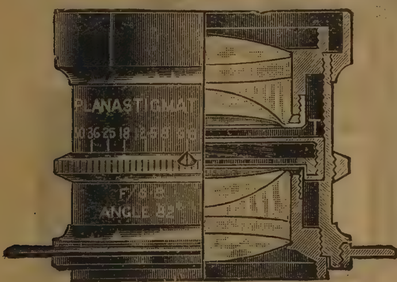
RAPID WIDE ANGLE LENS.

ANGLE 100°.

For Landscapes, Architecture, Interiors, Reproducing, &c., &c.

No.	Aperture in.	Equiv. Focus. in.	Plate covered.	Price inclusive of Iris Diaphragm.
1	½	3½	4½ by 3½	£2 0 0
2	$\frac{11}{16}$	4¾	7 ,, 5	2 2 0
3	$\frac{13}{16}$	5¼	8¼ ,, 6¼	2 5 0
4	⅞	6	9½ ,, 7	2 7 6
5	$1\frac{1}{16}$	7¾	11¾ ,, 9½	2 10 0
6	1¼	9½	1 ½ ,, 11½	3 12 6
7	1⅜	10⅝	15¾ ,, 11¾	4 5 0
8	1¾	$12\frac{5}{3}$	19¾ ,, 15¾	6 5 0

NEW 8 LENS SYSTEM PLANASTIGMAT.



Latest Construction. Angle 82°, 8 Lens System. The Best Instantaneous Lens for Universal Use.

Great rapidity, specially selected materials, flat field, sharp and critical definition to the extreme margin of the plate, great depth of focus. One of the best Anastigmats in the market. Can be used with full aperture, F/6·8 for any subject, architecture, portrait, copying or landscape work, and with a small stop make a splendid wide angle lens. The single combinations are perfectly corrected for Antigmatism, spherical aberration and achromatism, and may be used separately, giving a single lens of double the focus of complete lens.

PLATES COVERED.

No.	Equiv. Focus.	F/6·8.	F/12·5 to F/18.	F/50.	PRICE.
0	4¼	4½ by 3½	5 by 4	6 by 4½	£3 0 0
1a	5¼	5 ,, 4	6 ,, 4½	7 ,, 5	3 8 0
1	6	6 ,, 4½	7 ,, 5	8 ,, 6	3 15 0
2	7	7 ,, 5	8 ,, 6	9 ,, 7	4 10 0
3	8¼	8 ,, 6	9½ ,, 7	10 ,, 8	6 5 0
4	9¾	9½ ,, 7	10 ,, 8	12 ,, 10	7 10 0
5	10¾	10 ,, 8	12 ,, 10	13 ,, 12	9 5 0
6	12	12 ,, 10	14 ,, 12	15 ,, 12	11 0 0
7	14½	14 ,, 12	15 ,, 12	18 ,, 16	13 15 0
8	16½	15 ,, 13	16 ,, 14	20 ,, 15	17 10 0
9	19	20 ,, 15	21½ ,, 17½	24 ,, 20	22 10 0

The following lenses are made ready to fit into the Unicum Shutter at the following prices :—

0	4¼	4½ by 3½	5 by 4	6 by 4½	£2 14 0
1a	5¼	5 ,, 4	6 ,, 4½	7 ,, 5	3 2 0
2	7	7 ,, 5	8 ,, 6	9 ,, 7	4 4 0

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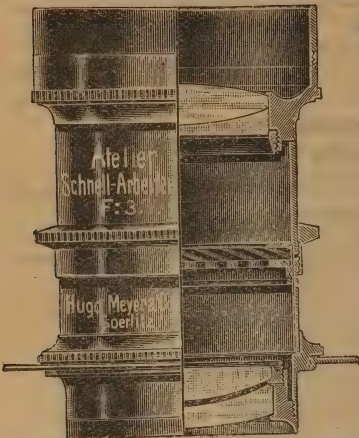

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F/3.

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Definition. — Soft and plastic, without losing anything in depth. Each lens is corrected for astigmatism and flatness of field, and differential focii are obviated.

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No.	Aperture. in.	Focus. in.	Size.	Price complete.
1	$2\frac{1}{8}$	7	for c.d.v. in short studios	£6 10 0
2	$2\frac{1}{2}$	$8\frac{1}{4}$	,, ,, ordinary studios	9 0 0
3	$3\frac{1}{4}$	$10\frac{5}{8}$	,, cabinet in short studios	13 10 0
4	$3\frac{5}{8}$	$12\frac{1}{4}$	,, ,, ordinary studios	18 0 0
5	4	$14\frac{1}{2}$	,, for boudoir	22 10 0
6	4	$15\frac{3}{4}$	,, for boudoir	25 0 0

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,,	6 ,, $4\frac{1}{4}$ ...	12	11	9	9	
,,	$6\frac{1}{2}$,, $4\frac{3}{4}$ ...	10	9	8	8	
,,	$7\frac{1}{2}$,, 5 ...	8	7	6	6	
,,	$8\frac{1}{2}$,, $6\frac{1}{2}$ ...	6	5	5	4	
,,	10 ,, 8 ...	12	10	10	9	4/3 ,,
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